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DEVELOPMENT AND EVALUATION OF RECORDED PROGRAMED EXPERIENCES IN CREATIVE THINKING IN THE FOURTH GRADE.

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THIS PROJECT INVESTIGATED TWO PROBLEMS RELATED TO THE DEVELOPMENT OF CREATIVE THINKING ABILITIES AT THE FOURTH-GRADE LEVEL--(1) THE DIFFICULTIES TEACHERS EXPERIENCE IN ENCOURAGING AND GUIDING CREATIVE EXPERIENCES IN THE CLASSROOM AND RELATING THEM TO CURRICULAR CONTENT AND (2) THE DEVELOPMENT OF WAYS FOR COUNTERACTING THE NUMEROUS INFLUENCES WHICH BRING ABOUT A SLUMP IN CREATIVE THINKING ABILITIES, MOTIVATIONS, AND ACTIVITIES AT ABOUT THE FOURTH-GRADE LEVEL. SUBJECTS OF THE STUDY INCLUDED 30 FOURTH-GRADE CLASSES FROM 3 STATES. TEACHERS IN THE PROJECT EXPERIMENTAL GROUPS AGREED TO USE EXPERIMENTAL AUDIOTAPES, AND THOSE IN THE CONTROL GROUPS WERE INSTRUCTED TO USE CONVENTIONAL INSTRUCTION. BEFORE THE EXPERIMENTAL MATERIALS WERE INTRODUCED, A NUMBER OF ASSESSMENT DEVICES WERE ADMINISTERED TO PARTICIPATING STUDENTS. NEAR THE END OF THE SCHOOL TERM AND UPON COMPLETION OF THE EXPERIMENTAL PROGRAM, ALL CLASSES WERE READMINISTERED THE CREATIVITY ASSESSMENT DEVICES. IN SPITE OF THE FACT THAT MANY OF THE TEACHERS IN THE CONTROL GROUPS USED A VARIETY OF DELIBERATE METHODS TO ENCOURAGE CREATIVITY AND THAT SOME OF THE EXPERIMENTAL CLASSES DID NOT PROPERLY USE THE EXPERIMENTAL MATERIALS, THE EVIDENCE WAS IN FAVOR OF THE EXPERIMENTAL PROCEDURES. (JC)

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PROGRAMMED EXPERIENCES IN CREATIVE THINKING

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report on title VII project
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E. Paul Torrance

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Principal Investigator

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Chapter 1

PROBLEMS IN DEVELOPING CREATIVE THINKING IN THE FOURTH GRADE

Two major problems in the conservation and development of creative talent are of concern in the project which will be described in this report. The first of these problems is related to the need for overcoming some of the difficulties teachers experience in encouraging and guiding creative thinking experiences in the classroom and relating them to curricular content. The second problem is focused on the need for developing ways of counteracting the numerous influences which bring about a slump in creative thinking, motivations, and activities at about the fourth grade.

Helping Teachers Learn to Encourage Creative Growth

In a sense, the Principal Investigator's recognition of the need for the project described in this report grew out of his relatively unsuccessful attempts to help teachers learn to encourage creative growth in children. In field experiments and in-service education workshops, he and his assistants had tried in various ways to assist elementary teachers to apply insights from research findings in developing the creative thinking abilities in their classrooms. The most generous interpretation of the results would credit us only with moderate success.

In one experiment (Torrance, 1964a), our efforts involved the provision of materials which would help teachers in assuming attitudes which would show respect for the questions, creative ideas, and other productions of pupils. In spite of an apparent eagerness on the part of the participating teachers, however, it was soon evident that many teachers have within themselves attitudes which make it extremely difficult for them to manifest such respect. This was even when they tried deliberately to do so. Next, teachers were supplied with a collection of many alternative ideas for creative activities in the language arts (Torrance, 1964a). Volunteer teachers, apparently eager to test the ideas, were encouraged to select from these activities those fitted to their personalities, skills, objectives, and the needs of their pupils. It was found, however, that the experimental teachers used no more of these activities than the control teachers not given the stimulus of the idea collection. The materials left much to the initiative of the teachers and were not sufficient to enable them to break out of their usual routines and tested activities.

Following these relatively unsuccessful experiences, the Principal Investigator and his assistants turned their attention to the idea of developing programmed or planned and guided experiences in creative thinking. These planned and guided experiences represented an attempt to avoid some of the failures due apparently to inhibiting attitudes, lack of spontaneity, lack of time, and perhaps lack of boldness or courage among many elementary teachers. R. E. Myers led the way in developing several sets of exercises which he later combined into workbooks or ideabooks and with the Principal Investigator developed teachers guides for their use (Myers and Torrance, 1961b, 1962, 1963).

B. F. Cunnington came forward with the idea of developing sets of tape-recorded materials which might bolster the teacher's spontaneity and ability to grip the imagination of children. In the creation of all of these materials a deliberate attempt was made to build into them what we have been able to discover about the creative process and the conditions which are favorable to the operation of this process.

The Fourth Grade Slump in Creative Behavior

The literature concerning creative growth, the development of the creative thinking abilities, and participation in creative activities during the elementary school years is fairly consistent, and amazingly so, considering the variety of measures that have been used, the variety of samples studied, and the wide time span covered.

Using ink spots, Kirkpatrick in 1900 reported that children in the first three grades are more imaginative than those in the fourth, fifth, and sixth grades. In his studies, there was an increase again in the seventh and eighth grades.

On the basis of compositions written by children from grades three through twelve, Colvin and Meyer (1906) found a general decline in imagination during these years. They maintained that the only type of imagination that showed substantial growth in the compositions they studied was the visual, and that this had become "symbolic and devitalized."

Simpson (1922) included grades three through eight in his studies of creative imagination. Beginning with a low point at the beginning of the third grade he found a sharp rise by the end of the year followed by a decline at the beginning of the fourth grade. This was followed by an upward trend until a peak was reached in the second half of the sixth grade, after which there was a decline in the seventh grade and a still further one by the beginning of the eighth.

Mearns in 1931 (reprinted in 1958) maintained that it was common knowledge that creative activity enjoys free expression during the first three grades and continues to some extent in the fourth and fifth grades. According to him, there is a rapid decline in the sixth and seventh grades, becoming a "vice loved in secret" by the eighth grade but eventually given up. He argued, however, that it could be revived at any age, even in adulthood.

Margaret Vernon reported in 1948 what she called constructive imagination did not occur in the child of normal intelligence and emotional development until age eleven. She based her conclusions upon ability to "understand fully pictures and to interpret them as a whole." She found that children at the age of eleven could "invent explanations of the scenes depicted, in terms of thoughts, emotions, and activities of the characters." Apparently Vernon was tapping what the Principal Investigator has called "ability to formulate causal hypotheses" in the Ask-and-Guess Test. The developmental curve for this ability rises slowly and gradually in the early school years and reaches a fairly good height at age eleven.

Ability to ask questions about the picture and to formulate hypotheses about consequences develop much earlier and show quite different developmental characteristics.

Barkan (1960) reported a number of interesting observations concerning the developmental process of creativity on the basis of his intensive observational studies of a small number of elementary teachers in their teaching of art. He observed that children show greater spurts of creative growth at some points than at others. Degree of growth from first to second grade seems to be more dramatic than from kindergarten to first grade. He found that the insatiable curiosity of second-graders about the "why" and "how" of things changes into a more alert quest for explanations in the third and fourth grades. He found that most fourth grade children tend to be perfectionistic and easily discouraged by undue adult pressure.

This perfectionistic trend at about the beginning of the fourth grade might be advanced as the basis of one explanation of decreased productivity in creative activities among fourth grade children. This decreased productivity was noted in a study by Weideman (1961) involving the composition of songs. Fourth grade children submitted a smaller proportion of songs than any other grade. Yet the fourth grade classes were more interested than those at any other grade level in evaluating the songs created by other classes. Furthermore, their judgment agreed more closely with the musical experts than did the judgments of classes at other grade levels. Decreased productivity in creative writing was noted in a study conducted by the Principal Investigator (Torrance, 1964a). In this study, children in grades three through six were encouraged to do a great deal of writing on their own outside of the curriculum. Fourth grade children submitted fewer items than the children in any other grade.

Wilt (1959) has written at length about the decline in creativity which occurs during what she calls the "stage of realism" and "gang age." She explains this decline on the basis of conformity to peer group standards and reports that much of the free-wheeling thinking, large swinging movements, and free action-packed art disappears. At this stage, about the fourth grade, symbols become stiff, clothes assume great importance, and male and female roles take on great significance. She maintains that only the unusual child can withstand the pressures to conform to behavioral norms at this stage. She observed that in a few children creativity returns after the crisis but that in most it is lost forever.

In the studies conducted by the Principal Investigator, an attempt has been made to develop tasks suitable for studying creative development from kindergarten through graduate school. Thus far, growth curves have been developed for grades one through twelve. The general pattern of the developmental curvesof most of the creative thinking abilities assessed by tests is as follows: There is a steady rise from first through third grade.

There is a sharp drop between the third and fourth grades followed by recovery (in fluency but not in originality) in the fifth grade or between the fourth and fifth grades. Another drop, less severe than the one in the fourth grade, occurs in the seventh grade. This is followed by fairly continuous development through the eleventh grade, after which there is a leveling off or slight drop. All of these findings have been based on cross-sectional studies. Results are not yet available from longitudinal studies.

Reasons for Concern About the Fourth Grade Slump in Creativity

There is considerable evidence to suggest that children unnecessarily sacrifice their creativity at about the fourth grade (Torrance, 1963a) and that in this process we lose much valuable talent and many problems of mental health, delinquency, and the like have their origin.

Let us examine first the problem of loss of talent. For purposes of illustration, let us consider the problem of conserving creative scientific talent. A number of thinkers have proposed the idea that at birth every child is a potential creative scientist. The young child is curious and is much interested in the world about him. I have suggested that if one observes the ways infants handle things, shake them, smell them, feel them, twist them, and manipulate them in many ways, he might find some of the beginnings of the manifestation of creative thinking. We may also see some of these beginnings, if we observe the infant's use of facial expressions, his efforts to interpret the facial expressions of others, and the process by which he differentiates his own body from the remainder of the environment. Since the infant has no vocabulary, he is limited in the extent to which he can learn by authority. Thus, by necessity, much of his learning must be creative -- sensing problems, making guesses, testing and modifying them, and communicating them in his limited way.

A number of science educators have tried to trace the process by which we begin with every child as a potential creative scientist and step by step eliminate them until we have all too few truly creative scientists. In tracing the course of this process, Watson (1958) maintains that even by the end of elementary school possibilities of a career in science are widely but not uniformly attractive. Thereafter, irrevocable negative decisions cut down on the "pool" of potential scientists in response to what is offered in high school in the name of science, a distaste for mathematics and a termination of studies in mathematics. He maintains that rarely does a student in high school or college who has become disinterested in science re-enter the diminishing pool of potential scientists. Further, Watson maintains, prevalent stereotypes of scientists as "eggheads," communists, or asocial beings; parental and peer attitudes; personal economic factors, and the like deter still others. Cooley (1958) in a far more detailed and meticulous manner has shown how potential creative scientists are eliminated one by one through the operation of such external variables as: religion, socio-economic status, ethnic background, geographic position, sex, race, social structure, home climate, siblings, economic conditions, college admissions policies, availability of scholarships, and discrimination practices.

A number of educators in recent years (Cole, 1956) have deplored the loss of intellectual talent represented by the failure of about 50% of the top 30% or so of the nation's high school seniors to enter college. Personally, I think that this represents an even greater loss than it appears on the surface.

In the first place, it would be a fairly safe guess to estimate that the 50% who choose not to enter college includes a disproportionate number of the highly creative ones. Even among high intelligent and creative kindergarteners, some can hardly wait for a school vacation, after they have been stopped "cold" in their enthusiastic efforts to learn and have been forced to learn by authority. After years of frustration, they start counting the days until they will be old enough to leave school, or to graduate. In the second place, we are concerned because we know that about 70% of those who would rank in the upper 30% on creative thinking would not even be among those counted among the top 30% on measures of scholastic aptitude.

There are a number of facts which suggest that many problems of mental health, delinquency, school dropouts, and the like are linked with the fourth-grade slump in creative thinking. Informal inquiries reveal that mental hygiene clinics, psycho-educational clinics, and various kinds of remedial clinics have a peak in referrals at about this same state of development. A survey in one metropolitan area showed that there were more such referrals in the fourth and fifth grades than in any other grades. Letters received by the Principal Investigator from parents concerning the problems of creative children (as identified by parents) show a definite peak at this same stage. It is also at this stage when some youngsters develop an extremely strong dislike for school and begin looking forward to the time when they will be old enough to drop out of school.

In another project directed by the Principal Investigator, an attempt is being made to understand the underlying dynamics of the fourth-grade slump in creative behavior. Although the project has not been completed, it seems rather certain that this slump is not purely a developmental phenomena but is a man-made or culturally-made one. In cultures having few discontinuities, the development of the creative thinking abilities appear to be continuous (Torrance, 1962a). Under selected teachers who like creative children and reward creative achievement, no slump occurs in the fourth grade.

The Principal Investigator has discussed the problem of the fourth-grade slump in creative behavior with a number of gifted sixth graders and they quickly point out many different influences which they believe have caused them to become less imaginative, curious, and original in their thinking at about this time. (An overwhelming majority of gifted sixth grade pupils are conscious that they themselves experienced such a slump.) In discussions with these children, they usually point out, "Well, when we went into the fourth grade, we were half-through elementary school and they expected us to act more grown up." As such a discussion continued, they pointed out that in the fourth grade they had to begin sitting in orderly rows in the classroom and keeping their feet on the floor. Their classroom activity suddenly became more organized and formal. They received credit only for what they "put on paper." The animals in their stories did not talk and were all about "real things." Usually, they had to go to another building, a different wing of the building, or upstairs in a two-story building. They had to start doing homework and their papers were expected to be neat with no smudges. The subject matter became different; they began having lessons in geography, history, science, and the like in a rather formal sense. They began taking part for the first time in student government and started serving as monitors of their fellow student's behavior.

As we tested children of this age with measures of divergent or creative thinking, we were impressed with the inhibiting influence of their preoccupation with prevention and their fear of making mental leaps or guesses. The problem, "What are all of the possible things Mother Hubbard could have done when she found no bones in the cupboard for her dog?", was easy for younger children but extremely difficult for many fourth graders. The fourth grader was so preoccupied with the notion that Old Mother Hubbard should have prevented this predicament that he could not think of how she could have gotten herself out of it.

In tests of creative thinking, children of this age also want to stick close to the stimuli and resist making mental leaps or guesses. In the Product Improvement Test this seemed to stem at least in part from the inhibitions surrounding costs. Uncertainty expressions are also frequent at this age level. These phenomena have been observed and documented by other investigators. For example, L'Abate (1957) found that nine-year olds showed a greater use of "uncertainty expressions" than other age-level groups. Professional workers in the field of remedial vision have also told us that they have observed this uncertainty in their work with children of this age. On the Rorschack Ink Blots, fourth graders will say that they are not as imaginative as other children, that they cannot make anything out of the blot, and the like. They will practice visual-training exercises endlessly but fail to make progress, continuing to be uncertain, hesitant, and slow in their perceptions.

In working with teachers, it has also become apparent that many teachers of the intermediate grades live in quite a different world from their colleagues who teach in the primary grades. Their educational experiences at the college level have been different. Their measured attitudes towards children are different and their methods of instruction are different. Many fourth-grade teachers admit frankly that they have little or no idea about what goes on in the primary grades.

In our research (Torrance, 1964a) we have also found that teachers of the intermediate grades say that they talk with children about their creative writing in ways which are different from the ways primary grade teachers say that they talk with their pupils about their creative productions. The primary teachers were the more willing to sacrifice preoccupation with correctness and form for creative values.

Potentialities of Planned, Guided Experiences in Creative Development

Once our evidence was strong enough to indicate that the fourth grade slump in creative thinking is not an unalterable developmental phenomenon, it was logical for us to begin searching for promising ways of eliminating it and possibly some of its accompanying ill effects. Although we believed that much of the answer lies in the relationship between the teacher and his pupils and the manifestation of values that reward creative growth, we realized that changes in these areas are indeed difficult to achieve. Thus, we believed that we might contribute to the solution of this problem most effectively by experimenting with the creation of instructional materials which provide planned, guided experiences in creative thinking. These materials should have built into them the best that we know about the creative process, the creative thinking abilities, and the creative person, as well as the best that we know about the nature, interests, and abilities of fourth-grade children.

Among others, Ojemann (1948) has called to our attention the need for caution in accepting as unchangeable some of the phenomena which have been discovered through developmental studies. He argues that development is quite different when children are provided planned learning experiences than when they experience only what the environment just happens to provide. Ojemann and Pritchett (1963) define "guided experiences" and "planned learning experiences" as attempts to assist a child or adult in learning by developing from an analysis of the learning task and the nature of the learner, a planned sequence of experiences for mastering the task and by motivating the person to participate in this experience. They use the term "unplanned experience" to refer to the experiences the environment happens to provide.

Ojemann and Pritchett (1963) report a study which describes a planned program for developing the concept of specific gravity. The program was tested using experimental and control groups at the kindergarten and first grade levels. At the beginning of the study, the stage of concept development was measured in individual interviews with the 39 subjects and again after administration of the learning program. The guided learning program consisted of a one-hour period on each of three successive days. Results indicated that a planned learning program can affect significantly the development of the concept of specific gravity at this age level and that the age levels for the stages suggested by developmental studies such as those of Piaget do not hold for a significant proportion of subjects when a planned learning program is applied.

Although Binet was committed to a mental-age concept of the growth of intelligence, his position regarding planned or guided experiences was in many respects similar to Ojemann's and he applied it in his work with mentally retarded children (1909). His "Mental Orthopedics" or exercises are similar in many respects to Ojemann's "guided learning experiences." Binet was especially sensitive to the need for planning in terms of the nature of the learner. In the area of creative behavior, Binet maintained that "all, or almost all, children before being given any instruction show a taste for singing, drawing, story telling, inventing, manipulating objects, moving them about, changing them, using them to construct others." He argues that we should "graft education and instruction on these natural activities" and thereby benefit from the start already made by nature. According to him, "nature furnishes the activity and the teacher intervenes only to guide it." This is in harmony with the Principal Investigator's belief that it is natural for children to learn in creative ways.

A number of studies have been reported concerning the use of specially constructed instructional materials for stimulating creative expression and growth. Films have been seen by a number of investigators as offering potentialities for stimulating creative expression and contributing to creative growth. Witty (1956) has reported results obtained by showing "The Hunter and the Forest," a story without words. Creative productions were evaluated according to the following criteria: the expression of genuine feeling; sensitivity to the value of particular words, phrases and larger language units in expressing feelings; response to the film maker's interest and the materials and symbols presented; and use of correct and appropriate English. Witty through this report called attention to the potentialities of films in contributing to creative development and to the identification of creative talent.

Berry (1958) has also reported a study of the use of films to increase creative expression. Though the study was not conclusive, it again called attention to the use of films for this purpose. It was concluded that films may stimulate ideas but that the children must have the vocabulary and other writing skills to express themselves. It is quite likely that most of the gains attributed to the films derive from the enriched imagery and warm-up which resulted.

Some educators stress the importance of variety in activities as a key to creative growth. Hill (1960), for example, stresses a variety of experiences and includes such activities as story-writing, storytelling, dancing, dramatics, problem-solving, critical thinking, painting, designing, reporting, and the like. She cautions, however, that there must in addition be an atmosphere of acceptance, time opportunities, adequate space, and the like. Creative writing, however, seems to be one of the most common types of activities teachers rely upon to help children release and develop their creativity. Even here, however, there has been considerable emphasis upon a variety of materials. Winters (1963) suggests the use of such helps as books, poems, puppets, stories, pianos, recorded music, sounds, colors, smells, and the like. She argues that "when things happen inside, children write creatively."

A number of investigators have recognized as more valuable the mental and emotional experience involved in creative activities than the products which result. For example, Bannon (1952) tries to show that in painting and drawing creatively a child engages in inventive thinking and develops a sense of space and color. She insists, however, that we must also be interested in the results. This is in harmony with the Principal Investigator's insistence upon the importance of children recognizing that their ideas are valuable.

The approach taken in the construction of the instructional materials developed in this project also relies heavily upon the experimental research of the Principal Investigator (Torrance, 1964a) and others. An example of a laboratory experiment which gives support to the approach taken in this project is one by Maltzman, Bogartz, and Breger (1958). In this experiment, two experimental groups and a control group were initially presented with a list of 25 words and free associations were evoked. The control group then received a new list of stimulus words (test list), not encountered in the training or practice list. The two experimental groups received five additional presentations of the practice list with instructions to give a different response on each presentation. One experimental group received intermittent verbal reinforcement for uncommon responses while the other experimental group did not. Both groups then received the test list. Half of the subjects within each of the three groups received originality instructions prior to the test. Subjects were 120 college students (60 men and 60 women).

Maltzman and his associates (1958) found that both the non-reinforced and reinforced experimental groups gave significantly more original responses compared to the control group with instructions to be original. The two experimental groups did not differ significantly in the originality of their responses. The Unusual Uses Test was administered following the free association test to estimate the generality of the effects of training and instructions to give uncommon responses. The results indicate that non-specific transfer may be readily produced by guided training experiences.

Studies by Neal (1957) and Hutchinson (1961) in actual classrooms indicate that planned, guided experiences can contribute to creative development in significant ways. Neal's study involved the selection and testing of teaching techniques for developing methods of scientific inquiry in grades one through six. She found that children can be aided through direct teaching procedures to identify and state problems, formulate plans to collect and evaluate data from a number of sources, formulate hypotheses and concepts, and apply concepts and methods to new situations. Testing data indicated a consistent pattern of growth for each method of scientific inquiry from grades four through six.

Hutchinson's (1961) study was conducted at the high school level. The control group received what Ojemann would call unplanned experiences, at least insofar as creative development is concerned. The experimental group received what he would call planned or guided experiences which involved opportunities for using divergent thinking and evaluative abilities in acquiring information and skills. The experimental group showed statistically significant gains over the control group on apparatus fluency, plot titles fluency, clip uses fluency, and clip uses flexibility. He also found a significant correlation at the .01 level between mental age (as measured by an intelligence test) and the difference achieved on the subject matter test from the pre-test to the post-test for the control group. In the experimental group, this coefficient of correlation was -.04. In other words, the change of instructional methods appeared to affect the gain on subject matter made by the high IQ student who has traditionally found the instruction geared for him. In the experimental group, the coefficients of correlation between subject matter achievement and the measures of creative or productive thinking increased. In fact, some of the students in the lowest quartile on the measure of intelligence became productive stars under the experimental conditions.

Essentials of the Task of Constructing Planned Experiences

The most obvious problem in constructing planned experiences in creative thinking is to provide materials which can be taught by ordinary teachers without special instructions to ordinary students. These materials must, at the same time, reflect the best that is known about creativity and the basic or underlying principles of the various curricular areas such as reading, language arts, social studies, science, music, art, mathematics, and the like. In the next chapter, we shall attempt to describe the planned experiences which we developed and how we went about developing them.

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Chapter 2

PLANNED EXPERIENCES IN CREATIVE THINKING

Development of Instructional Materials

In instructional materials developed for use in this project represent a deliberate attempt to produce a set of materials which have built into them the best that we know about the creative thinking process and those conditions which facilitate it. An attempt was also made to construct these materials in such a way that they could be used in the best traditions of planned guided educational experiences, making use of our knowledge of the learning task and the nature and functioning of the learner. Each of the twelve units provides a planned sequence of experiences for developing the skills of creative thinking and suggestions for motivating fourth-grade pupils to participate in these experiences. This approach to constructing instructional materials is in the tradition developed by Ojemann (1948, 1963).

An analysis of the learning task involved suggested that emphasis be given to the following five major objectives:

1. To discover, motivate and develop creative awareness
2. To develop an understanding of the nature and value of creative thinking and creative achievement
3. To provide provocative data in the form of a dramatized supplement to the curriculum in the fields of science, history, geography, and the language arts
4. To stimulate and guide creative behavior
5. To create an awareness of the value of one's own ideas.

It was desired that the bulk of the instructional materials correlate with the usual curriculum of the fourth grade. Thus, it was established at the outset that one-fourth of the materials would deal with great moments of scientific discovery and invention; one-fourth, with great moments in historical achievement; one-fourth, with great moments in geographical discovery; and one-fourth, with fantasy and related largely to language arts. In spite of this division, however, it was intended that any single planned sequence of educational experiences might take the learner into several curricular fields. For example, one of the tapes in the "Great Moments in Scientific Discovery" series might lead directly to art and creative writing experiences. These in turn might lead to activities in reading, history, music, arithmetic, character education, psychology, economics, government, and other areas of science.

In order to provide data for deciding upon the content of the science, history, and geography materials, a questionnaire was sent to over one hundred fourth-grade teachers and elementary supervisors who had expressed an interest in creative educational experiences. A list of possible titles were submitted in each category and the titles chosen were those most frequently approved by the responding teachers. (Approximately 95 per cent of the teachers and supervisors consulted returned their questionnaires.) The following titles with brief resumes were offered (see Appendix for copy of questionnaire):

History Titles (Great Moments of Discovery):

"From Reaper to Riches" (Cyrus McCormick)

"The Silent Seamstress" (Elias Howe)

"A Lesson for the Professor" (Elihu Thompson)

"See 'em Move" (C. Francis Jenkins)

"The Caterpillar that Made History" (Benjamin Holt)

"The Night the Furnace Door Snapped" (John Spencer)

"The Literary Piano" (Christopher Sholes)

"Bedrooms to Wheels" (George Pullman)

"Sing a Song of Streetcars" (Van De Poel and Sprague)

"The Invisible Beam" (Taylor and Young)

"The Plane that Couldn't Fly" (Edward Link)

"Louder, Please" (Lee DeForest)

"From a Whisper to a Shout" (Rice and Kellogg)

"Pistol with a Payload" (Sam Colt)

"The Iron Shark" (John Philip Holland)

"The Kite that Made History" (Benjamin Franklin)

"The Eli Whitney Story" (Eli Whitney)

"Fulton's Folly" (Robert Fulton)

"Chewing Gum and Bailing Wire" (Wright Brothers)

"Eyes at Their Fingertips" (Louis Braille)

Science Titles (Moments of Discovery):

"The Fortunate Accident" (Charles Goodyear)

"The Little Black Box" (George Eastman)

"From Matches to Magazines" (General Benjamin Tilghman)

"Stop on a Dime" (George Westinghouse)

"Send the Word" (Samuel F. B. Morse)

"Talk Here" (Emile Berliner)

"Voices on the Wind" (Alexander Graham Bell)

"With a Flick of the Wrist" (Thomas A. Edison)

"Get a Horse" (Henry Ford)

"Trailblazer to the Stars" (Robert Hutchings Goddard)

Respondents were invited to suggest additional titles of interest to them and to their pupils.

It was originally intended to develop a total of sixteen units, with a new unit being introduced every other week. It was discovered, however, that with the rather extensive testing and evaluations at the beginning and again at the end of the school term and the various school holidays and vacations that it was possible to schedule only twelve sets of materials. The titles finally used in the field tests are as follows:

Fantasy Titles

"The Dog They Named King"

"Giovanni and the Giant"

"Christmas Minstrel"

"Sounds and Images"

Science Titles

"Trailblazer to the Stars" (Goddard)

"All-Around American" (Franklin)

"Master of Miracles" (Edison)

History Titles

"Eyes at Their Fingertips" (Braille)

"Wizard on Wheels" (Ford)

"Wings for the World" (Wright Brothers)

Geography Titles

"Captains of Courage" (Lewis and Clark)

"Polar Pilot" (Byrd)

Before discussing the curricular content of these materials, it seems desirable to identify and discuss briefly the research insights which guided the development of the tapes and the teachers guides to accompany them.

Research Insights Which Guided the Development of Materials

Definitions of Creative Thinking

The Principal Investigator has discussed definitions of creative thinking in considerable detail in other sources (Torrance, 1962a, 1964a). Perhaps it is sufficient here to say that for research purposes we have defined creative thinking as the process through which a person becomes sensitive to or aware of a problem, a deficiency, or a gap in knowledge; formulates hypotheses and experiments to find a solution; modifies and corrects hypotheses; and communicates the results. Implied in this definition is the creation of something new, something which has never been seen or something which has never before existed. It involves adventurous thinking, getting away from the obvious and commonplace. It represents a successful step into the unknown and unexplored. In the process, one thing must lead to another. Included are such products as scientific theories, inventions, improved products, novels, poems, designs, paintings, and the like.

Some Assumptions

Before attempting to set forth the research insights which guided the construction of the planned experiences which constitute the materials developed through this project, we had accepted several rather important assumptions. For example, it had been assumed that the abilities and motivations involved in being creative are universal. Everybody possesses these abilities to some degree and has needs or motivations which exert pressures in the direction of the use of these abilities. It was also assumed that these abilities are capable of being increased or developed through educational experiences and that it is one of the school's legitimate functions to provide such experiences.

Guiding Insights or Hypotheses

In this section, we shall identify some of the guiding insights and hypotheses which influenced the design of the instructional materials developed through this project. Insofar as possible, some of the most pertinent research supporting the insight or hypothesis will be cited.

1. Value Creative Thinking.

The accumulated evidence from educational research in general and research concerning creative thinking in particular attest to the importance of valuing creative thinking in the classroom. It is the Principal Investigator's belief that every educator from kindergarten through the graduate school should ever be on the alert to notice new ideas proposed by children and young people, and to encourage them to continue the development of their creative talents. Every educator should consider this as important, or more important, than teaching information. The creative thinking abilities, however, can apparently be useful in acquiring information.

Numerous studies make it rather clear that children achieve those things which are valued by the society in which they live. In the matter of evaluating school achievement, there is considerable evidence to indicate that most people achieve those things on which they are evaluated or "graded." To them, these are "the things that count." If we expect students to develop creatively, we must learn to evaluate and give credit for creative kinds of achievement.

One of the obstacles to achieving the goal of giving credit for creative behavior stems from the difficulty of a conforming, conventional teacher in recognizing and appreciating the contributions of an unconventional and unloved or unlovely child. Several studies (Getzels and Jackson, 1962; Torrance, 1962a) indicate that highly creative children are regarded by teachers as less desirable than highly intelligent ones, even though there is no difference in their measured educational achievement. Another obstacle results from our tendency to overrate the finished product or the "cultural conserve" -- the finished poem, the masterpiece of music or art, the balanced interpersonal relation, the organized behavior of the championship basketball team, and the like. We are easily deceived by the comparative perfection and smoothness of these masterpieces and evaluate them as if they were the immediate deliveries of some creative act.

Guided, planned experiences in creative thinking attempt to lead teachers in valuing creative behavior in several ways. The dramatized episodes from the lives of great creative people attest to the value of creative achievements to society. The very fact that children are given opportunities to engage in creative thinking and that time is devoted to such activities is another indicator of the value of creative behavior. If the teacher enjoys these activities, children see the possibility of joy in educational experiences. The teachers guides contain many specific suggestions for talking with children about their creative products and in rewarding a variety of kinds of creative achievements.

2. Make Children More Sensitive and Open to Environmental Stimuli.

A number of recent studies of highly creative individuals in a variety of fields (Stein and Heinze, 1960; MacKinnon, 1962) emphasize the importance of being sensitive or open to some type of environmental stimuli. The Principal Investigator on the basis of some exploratory studies has hypothesized that it is a matter of being sensitive and open to the particular kinds of stimuli which furnish the raw materials for the particular kind of creative behavior involved. For example, a person can be creative about interpersonal relations by being sensitive to human feelings, emotions, needs, and the like and it may not matter that he is not sensitive to chemical phenomena.

The creative chemist, however, needs to be highly sensitive to chemical phenomena and it may not matter that he is insensitive to many interpersonal phenomena, at least insofar as his creativity as a research chemist is concerned (Stein, 1956).

There is a need, however, to help children become more sensitive to a wide range of environmental stimuli. The evidence indicates that children can be guided through planned experiences to sense such stimuli more clearly and vividly and that this affects the quality of their creative productions. In one experimental validation of this idea, Littwin (1935) tried three methods of developing imaginative writing with three matched groups of seventh and eighth-grade pupils. Over a ten-week period, one group practiced writing vivid descriptions of pictures which they had previously studied, the second group studied literary models containing words of sound, color, and movement. A third group practiced describing all the possible sensations, such as sight, smell, touch, and hearing, that they could experience in examining an object or situation. The group emphasizing perception through the various senses showed significantly greater gains on composition test than did the other two groups.

3. Encourage Guessing, Experimenting, and Manipulating.

Apparently the young child has an almost irresistible tendency to manipulate and explore objects, and this seems to be the basis of curiosity and much inventiveness. Studies by the Principal Investigator (Torrance, 1963a) show a significant relationship between degree of manipulation and the quality and quantity of inventive responses. In administering one test of creative thinking, records concerning degree of manipulation were made on 68 first graders, 62 second graders, and 82 third graders. Tasks permitting manipulation of objects required subjects to invent improvements for a nurse's kit, a fire truck, and a toy dog which would "make them more fun to play with." Three degrees of manipulativeness were determined: high (touching, pulling, smelling, etc.), medium (an observable degree of manipulation or handling), and low (no manipulation). The results show marked differences between the fluency, flexibility, and originality of the responses made by these three groups of children at each grade level. It was also found that boys are more manipulative than girls and become increasingly more manipulative from the first through the third grade but girls do not show any such developmental tendency. From these and other data it seems important that children be permitted and encouraged to manipulate, to play, and experiment with objects and ideas.

Many teachers resist strongly ideas which involve guessing and activities which may seem like play. Bruner (1960) and others believe, however, that there are certain kinds of situations in which guessing is desirable and can facilitate the development of intuitive thinking. There may be a kind of guessing that requires careful cultivation rather than punishment. Bruner cautions, however, that one would not like to educate students to do nothing but guess and should be followed up with as much verification and confirmation as needed. Penalizing guessing too severely may restrain all types of thinking except the most obvious, commonplace, and banal.

Students should be given training in recognizing the plausibility of guesses and in determining when guessing is too costly. They should be taught to organize and use minimal information to draw a maximum number of inferences. An effort has been made to build into the instructional materials developed in this project many opportunities for these types of training and practice.

4. Teach How to Test Systematically Each Idea.

One of the most widely accepted objectives of education is to teach the young to test reality, to give them a realistic picture of the world in which they live. Yet I have observed at all levels of education and in many areas of adult life the rejection of brilliant and imaginative ideas with no testing. It would seem from the best evidence available that teachers should show pupils, beginning in the early grades, how to define a problem and keep testing each suggestion systematically. For instance, in a practical problem the teacher or the class might identify the different ways the problem could be solved and encourage the pupils to try out the various possibilities. After trying the various possibilities, the child could then be permiteed to decide for himself which is best.

Our experiences indicate that this can be done at a relatively early age, perhaps even before the fourth grade. For example, the Principal Investigator observed a third-grade teacher direct such an experimenting and testing experience in an art lesson by using autumn leaves. The children had gathered a great variety of leaves. Each child was given two sheets of paper, one to experiment with and the second to use for the final production. The children joined in a variety of of experimentation. They piled leaves on top of one another, arranged them in various patterns, and the like, and placed the paper on top and rubbed wax crayons over the paper. They tried various colors. They tried rubbing hard with the crayon, rubbing light with the crayon, and the like. After this, they examined the work of the class to decide what arrangements worked best, what colors showed up best, whether hard or light rubbing produced the best effects, etc. About three months later, I had an opportunity to observe these same children in an experiment requiring creative scientific thinking. The quality of the creative thinking of many of them was impressive. They spontaneously developed and tested hypotheses. It was clear that habits of experimentation and testing ideas was for them rather well established behavior.

From a variety of sources, there is considerable evidence to support the importance of training children to test systematically their ideas. In the domain of the experimental sciences, Taton (1957) points out that whenever a new theory arises, or when old theories seem to be in error, the experimenter is forced to confront reality with the consequences of the theory and this comparison may lead to the initial idea for a new scientific discovery. In the realm of mental health, Patrick (1955, p. 89) maintains that the lack of verification or revision is the major difference between psychotic imaginative thinking and the creative thought of the healthy person. Training children to test their ideas and those of others against reality will also serve to safeguard us against some of the so-called creativity which should legitimately be regarded with suspicion. This kind of search for truth will safeguard us against brainwashing, Fascism, Communism and the like.

5. Develop Tolerance of New or Divergent Ideas.

For some time, the Principal Investigator has held that one of the more serious defects of our educational system is that a disproportionately large emphasis is placed on the establishment of behavioral norms rather than on the production of original work. This does not mean that he is not strongly in favor of children's learning correct answers. In fact, he believes that there are some facts and some skills that are so important that children should be required to remember them and establish them firmly in their response repertoire. Such important, firmly established facts and skills give children anchors against which to evaluate original responses and provide the sources from which new ideas can be generated. We are simply opposed to giving exclusive attention to the one correct answer.

Our observations in classrooms and the incidents which teachers describe both indicate that many teachers are annoyed when a pupil presents an original answer which differs from what is expected, because it does not fit in with the rest of their scoring schemes for grades. They have to stop and think themselves how the unusual responses should be treated; in many cases, they cannot decide or are too fatigued and harassed to think through the child's idea. This is naturally disturbing. If habits of submitting ideas to reality tests have been established, there is a basis for tolerance. In fact, an important role of the teacher or leader in a group is to protect and obtain a hearing for minority ideas and solutions to problems.

Along with the tolerance of new or different ideas there must also be tolerance of the divergent personality -- the child who is "different." When a person thinks in ways which are customarily taboo, his peers may look upon him as mentally unbalanced. Barron (1958, 1963) and others regard this kind of imbalance as healthy rather than unhealthy. The truly creative person is ready to abandon unproductive or erroneous concepts and sees in life many rich and new possibilities. He sees as shortsighted the claim of society that all its members should adapt themselves to a norm for a given time and place, especially if the norm itself seems absurd. For example, teachers might contribute to tolerance for creative or divergent personalities by helping pupils to test against reality many of their misconceptions concerning inventors, scientists, poets, and artists. That such erroneous and damaging concepts exist has been demonstrated through the research of Remmers and his associates (1957) and Mead and Metraux (1952).

In the dramatized episodes of the recordings which are a part of the planned and guided experiences, an effort has been made to present creative persons as honestly and as authentically as possible. No effort has been made to make a person like Robert Hutchings Goddard or Thomas Alva Edison conform to the model of the "All-American Boy." They are presented with their peculiarities, their ideals, their honesty, their dreams, their desire to serve humanity, their struggle to be themselves, and their great intellectual courage. In the bibliographies provided in each teachers guide there are lists of authentic sources for both teachers and pupils. Numerous investigatory activities are suggested for helping children learn to respect and to value the creative persons for what they are and for what they contribute to society.

6. Beware of Forcing a Set Pattern.

Creative behavior almost always involves a breaking away from set patterns of behavior.

Creativity occurs when two or more pieces of information, two or more ideas, or two or more objects are put together for the first time to form a new idea, hypothesis, solution to a problem, machine, or other product. The more improbable or unexpected the new combination is the more creative it is. This requires imaginative, intuitive approaches rather than analytical ones. It is true, however, that creative ideas are often built upon previous ones and this is illustrated repeatedly in the lives of the creative persons portrayed in the recordings developed for this project.

It is quite unlikely that just as there is a scientific method there is a creative method. No one seems to be quite ready to formulate this method, but it seems rather certain that it will recognize a vast variety of work methods. There are many ways to describe a flower, plan a house, write a paragraph, or test a scientific hypothesis. Freedom and permissiveness, responsiveness, with no more guidance than is necessary seem to be important ingredients of much creative work. Again, a deliberate attempt has been made to integrate these ingredients into the experimental materials tested in this project.

7. Develop a Creative Classroom Atmosphere.

Creative behavior cannot be summoned at the will of the teacher or "ordered by the numbers." It must come as a culminating experience in the development of skills and acquisition of knowledge. Burrows, Ferebee, Jackson and Saunders (1952) explain that fourth-graders can write well only as the climax of a long series of activities. First, they must have available much concrete information and become deeply immersed in the subject matter. They must share findings through talking, listening, and illustrating before they can write creatively. This is a part of the motivation for writing creatively. The enthusiasm from working in this kind of classroom atmosphere becomes truly electric. This is what provides "great teachable moments" (Carlson, 1961) when there is just the right mood, feeling, and desire.

In the process of conducting research in elementary schools, we have begun to feel that we can identify rather accurately teachers who develop creative classroom atmospheres, without ever seeing the teacher. First, it is reflected in the artifacts found in the room, the way things are organized, the resources for carrying out ideas, and the like. It is even clearer when we start administering a test of creative thinking or even a task such as the "Draw-A-House-Tree-Person Test." There is an atmosphere of "released control," responsiveness, a sense of security, an absence of fear, and flexible ways of working together. For example, the Principal Investigator became quite curious about the reactions of classes to the use of rulers in making their drawings. In some classes, no one thought of using a ruler. In most, some child asked if it were legitimate to use rulers. In what the Principal Investigator considers the most creative class he has studied (a third-grade class), almost every child took out his ruler and used it appropriately and flexibly. No one thought to ask if it were legitimate. He had told them that they could make their drawings in any way that they liked and they took him at his word. They had been experiencing a permissive, responsive classroom atmosphere and had learned to use creatively whatever resources were not forbidden.

A classroom group may itself stimulate certain types of creative thinking. Children should learn early that creative ideas are to be shared and enjoyed by the group. Numerous suggestions for encouraging this kind of behavior are offered in the teachers guides. The Principal Investigator has been tremendously impressed by the ability of first grade children to do "group brainstorming."

They very effectively hitchhike on the ideas of one another. The role of the low participator in these first-grade groups tends to be particularly important. The high participators elaborate the ideas of the low participators. After considerable elaboration on an idea has occurred, one of the low participators will then chime in with an idea which sets the group off on an entirely different line. In this way, the group benefits from the ideas of highly creative, but often silent, members. In the fourth grade, this does not occur spontaneously. There must be a creative atmosphere. Quite obviously, it also takes more than materials to create this kind of atmosphere. An attempt has been made, however, to show teachers how materials can be used in creating this kind of creative atmosphere.

8. Teach the Child to Value His Creative Thinking.

Few creative scientists can recall when they first became interested in science. The interest began so early. Somehow curiosity was rewarded and the child experienced his ideas as valuable at an early age. Both theory and research regarding creative achievement make clear the importance of the child's learning early to place value on his own ideas and to trust his perceptions of reality. One approach to this is to encourage the child to form the habit of recording what he thinks. This helps him to appreciate the value of his imagination and at the same time discourages excessive daydreaming. As the child sees his own ideas expressed in some concrete form, he is encouraged to continue his efforts.

With older students, it is good to have them form the notebook or "idea-trap" habit (Torrance, 1964a). We frequently let good ideas slip away from us, because we do not memorize them or record them on paper. Even though the idea may at the time seem far-fetched and it is difficult to determine its real significance, it is wise to record it. The idea can be criticized, modified, or rejected at a later time, or it may spark another really important idea. Many inventors (Rossman, 1931) and idea men (Clark, 1958) report that this habit pays off richly. Experiences in synectics (Gordon, 1961) and other deliberate methods of invention and scientific discovery indicate that even fantasy may be used productively.

9. Teach Skills for Avoiding Unnecessary Punishment.

The importance of valuing the highly creative person so that he will not have to exist as a miserable deviate in the shadow of his more athletic and socially adept peers seems obvious. This, in fact, is one of the reasons why we have steadfastly refused to change our great creative heroes into athletically inclined and socially adept persons. Instead, we have tried to present them as they were.

Many observations, however, indicate that highly creative persons, especially children, bring upon themselves many of their own woes. In one study (Torrance, 1963a), we formed groups of five children and in each we placed one of the most creative children from the classroom. We then placed each of these groups in a situation requiring creative thinking and involving competition among groups as groups. Five groups at each grade-level from the second through the sixth were studied. The focus of our observations was upon the means used by the groups to control the most creative member and the strategies of the most creative member of the group in coping with these pressures.

Much of the behavior which we observed suggests that the highly creative person may in many cases be responsible for his own punishment. At the second-grade level, our subjects displayed what we regarded as rather primitive behavior. The most creative members of these groups were quite unpleasant, showing little consideration for the group, little or no goal-orientation, and little or no identification with the group. They also paid little attention to the leadership attempts of their less creative peers. In the fourth grade, the most creative members of groups assumed little responsibility for leadership and were given little credit for the important contributions which they actually made to the group's success.

An examination of almost any of the many lists of personality characteristics of highly creative individuals (Torrance, 1962a, 1964b) suggests that it may be almost inevitable that such persons will alientate their peers. For example, look at the following sample list of characteristics found by Sprecher (1959) for highly creative engineers: independence of thinking, production of novel and unconventional solutions, preference for new and difficult problems, energy and alertness, high degree of technical knowledge and academic achievement. It seems obvious that the problem resolves itself into one of helping an individual maintain those characteristics which seem essential to the development of his entire creative talent while at the same time helping him to acquire skills for avoiding or reducing to a tolerable level the peer pressures, so that he will find an opportunity to express his creative talent.

On the basis of his research with creative research chemists, Stein (1956) offers a set of interesting suggestions concerning the problem of getting along with one's peers and at the same time maintaining one's creativity. If we translate Stein's principles, intended for industrial researchers, the advice to teachers would run something like the following: Help the highly creative child to maintain his assertiveness without being hostile. He must be aware of his superiors, peers, and subordinates as persons. He may work alone but he must not be isolated, withdrawn or uncommunicative. In the classroom he must be congenial and agreeable but not sociable; outside the classroom, he must be sociable but not intimate. He must "know his place" without being timid, submissive, or acquiescent and must "speak his mind" without being domineering. As he tries to gain a point, he can be subtle but not cunning or manipualtive. In all relationships, he must be sincere, honest, purposeful and diplomatic but not unwilling to accept "shortcuts." In the intellectual area, he must learn to be broad without spreading himself too thin, deep without being "bookish" or "too scientific," and "sharp" without being overcritical. This model may ask too much of the child, but at least provides a model which the highly creative child apparently needs to achieve. The planned, programmed experiences constructed in this project offer many opportunities for reinforcing behavior in line with this model and in the teachers guides a deliberate effort is made to assist the teacher in accomplishing this task.

10. Give Information About the Creative Process.

Traditionally, the creative process has been left pretty much to chance. Psychologists surveying the educational scene at all levels have become increasingly convinced that the process of acquisition, impression, intake, and learning skills have tended to dominate over those concerned with production, expression, output, and creation (Patrick, 1955, p. 161).

It would seem that educational psychology can do much to reduce the fears of teachers and pupils that their creative abilities are absent or negligible by acquainting them with an understanding of the creative process and the conditions under which creativity flourishes.

The steps in the creative process seem to be rather well established and the process appears to be essentially the same regardless of the activity. Descriptions of the process have recently been offered by Patrick (1955), Rossman (1931), Brandwein (1955), Russell (1956) and others. First, there is apparently the sensing of a need or deficiency, random exploration, and a clarification or "pinning down" of the problem. Then ensues a period of preparation accompanied by reading, discussing, exploring, formulating many possible solutions, and critically analyzing these solutions for advantages and disadvantages. Out of all of this activity comes the birth of a new idea -- flash of insight, illumination. Finally there is experimentation to evaluate the most promising solution and the selection and perfection of the idea.

The work of Osborn (1963) and the Creative Education Foundation have done much to promote the idea that individuals and groups can be taught principles which will increase markedly their ability to develop a larger number and higher quality of creative ideas. In general, however, these schemes have not yet been submitted to systematic scientific tests in any detailed way so that we can determine what features have what kinds of effects. In one experiment, the Principal Investigator (Torrance, 1963a) attempted to test simultaneously two of Osborn's principles with elementary school children. One of his principles is to encourage quantity of production and what he calls "free-wheeling" of ideas without concern for quality, at least temporarily. Encouragement has also been given to the use of a set of principles to generate new ideas. These principles include: putting to other uses, adapting, modifying (changing color, motion, sound, odor, form, shape, etc.), magnifying, minifying, substituting, rearranging, reversing or changing positions, combining, and the like.

In our experiment, all of the pupils in two classes at each grade level (one through six) totaling 386 were divided randomly into four experimental groups. Two groups were trained to use the set of principles listed above to aid them in developing ideas to improve a product such as a toy. The other two groups received no training but otherwise were given the same orientation, including the information that prizes would be awarded for the best performance in each group in each grade. One of the trained and one of the untrained groups were motivated by pointed, verbal instructions to produce as many ideas as possible during an 8-minute period, without concern for quality. The test task was to produce ideas for improving a toy dog so that it would be "more fun for boys and girls to play with."

At all grade levels, there was a consistent tendency for the trained subjects to produce more flexible responses, and more original responses than the untrained ones. In the first and fifth grades, the differences were not statistically significant, except for flexibility in the fifth grade. (Other investigators have since replicated the experiment in the first grade, using a longer training period, and found highly significant differences.) Although the general effects of the motivation stimulated by the competition seems to have been quite powerful, the differences due to motivation for quantity versus quality are inconsistent and except in the second and fourth grades are not statistically significant.

These results were interpreted as being encouraging and indicative that it is not necessary to let the production of creative ideas continue to be a matter of chance it has tended to be in the past. A major effort in the development of the experimental materials of this project has been to apply the insights just cited. The stories of highly creative persons and how they came to achieve their "great ideas" help to acquaint children with the nature of the creative process. Suggestions in the teachers guides and lesson materials outline ways by which children can gain experiences in participating in kinds of thinking experiences similar to those of the particular creative person under study. Many of the recorded lessons set up exercises or experiences which encourage the use of various principles of deliberate idea production.

11. Dispel the Sense of Awe of Masterpieces.

In an attempt to develop an appreciation of the great creative masterpieces, educators have frequently been guilty of producing a sense of the perfection of these masterpieces. There is some reason to believe that this sense of awe constitutes a barrier to the development of creative talent. Much of this awe can be dispelled, Patrick (1955, pp. 183-184) maintains, if teachers take the time to show in detail the methods which the artist, author, scientist, etc. used. For example, a teacher in tracing the development of a famous painting or piece of sculpture could show how the artist obtained the main idea and then elaborated it. Some of the accounts of Michaelangelo's experiences would be excellent for this purpose (Stone, 1961; Clements, 1961).

If a child is shown how a masterpiece is developed step by step, he will stop thinking of it as something beyond his reach and will gain confidence that he too can do something original and worthwhile. Most theories of physical phenomena can also be shown to have evolved through successive approximations (Taton, 1957; Schwartz & Bishop, 1958).

In this connection, Wilson (1958) suggests the following reminders that teachers can keep before children and it is these that have been built into the experimental materials of concern to us:

a. All have creative abilities, but not all in the same areas.

b. Even though someone may have done it before, it still might be creative to you.

c. When we are blocked in the solution of a problem, maybe we need to learn new techniques.

d. The solution of our problem doesn't always come after prolonged study of the subject. It may come like a flash after a rest or it may come while one is engaged in a completely different occupation.

e. Above all, don't be afraid to express all the thoughts that come to you, no matter how unusual they may seem.

Out analysis of the practical task involved in regard to overcoming awe of masterpieces in presenting the lives and achievements of eminent creative people suggested that the problem is one of providing challenging but not threatening or overwhelming tasks.

The best evidence from the psychology of perception seems appropriate here. People are challenged to rise to the occasion and reach the heights of their mental functioning when they feel capable of coping with a task, but feel threatened and fail to rise to the occasion if they see no hope of coping with the situation. An effort was made to find challenging tasks within the fourth grade's competencies but which are analagous to those achieved by the eminent creative person (Franklin, Goddard, Edison, etc.). Throughout the teachers guides, however, there are suggestions for individual or independent activities and suggestions for individualizing instructions. It is well known that a teacher may believe that he is challenging a child when he may actually be threatening him. If all children are expected to engage in the same kind of creative activity, it is almost inescapable that some will be unchallenged and others will be threatened.

12. Encourage and Give Credit for Self-Initiated Learning.

Apparently the first signs of creative thinking in children occur in the spontaneous accompaniment of problem-solving activities motivated by their curiosity. One mark of the highly creative person is his exceptional self-starting ability. The strong curiosity of the child and his exploratory tendencies suggest that all or almost all children have this self-starting ability. The problem is to keep it alive and this seems to be especially crucial in the fourth grade.

It seems that this self-starting ability is hindered by overly detailed supervision by parents and teachers. It is quite possible that too much reliance is placed upon prescribed curricula and that we need to make more deliberate efforts to appraise and credit creative growth resulting from the student's own initiative. Since it is quite apparent that the rate of change has increased and we can expect even greater increases in the rate of change, an important goal of education would seem to be to equip children somehow with the motivations and skills for continued learning. Perhaps we would contribute more to future achievement if we did not try to teach such a large number of subjects and allowed time for self-initiated learning, thinking creatively in depth about the subjects taught, and the like.

The reasons for evaluating and crediting self-initiated learning seem quite simple. Because grades and credits are important to students, they tend to achieve whatever is necessary to achieve the grades they desire. If we base our evaluation on the memorization of details, students will memorize the texts and lectures. If grades are based upon ability to integrate and apply principles, they will attempt to do this. If credit is given for original ideas and self-initiated learning, they will achieve these goals.

On this point, much depends upon the school's policies about grading and upon the teacher's attitudes about what kinds of achievement should be encouraged or discouraged. What has been attempted in the creation of materials is to provide experiences which will naturally generate motivation for acquiring additional information and skills and to suggest ways of achieving this goal.

13. Create "Thorns in the Flesh" or Problem Awareness.

There is rather general recognition among students of creative thinking that the essence of creativity lies in a sensitivity to defects, the recognition of some kind of disturbing element.

Northrop (1953) maintains that no one is a creative thinker unless continuously he has a thorn in his flesh. Thick-skinned people, he says, do no creative thinking. To them, everything is understood, nothing is baffling, there are no problems. Having become sensitive to a disturbance, the creative thinker stays with it, analyzes it, and finally comes up with some kind of speculative answer which is then confirmed by empirical experimental evidence.

Fourth-grade teachers can do much to create these thorns in the flesh in their pupils. The child's own tendency to develop "thorns in the flesh" can be supported by helping him discover the answers to his questions, no matter how ridiculous or impossible they may at first seem. Above all, the teacher should not try to suppress and ridicule questions just because he cannot answer them. The experimental materials constructed in this project provide numerous applications of these ideas. In the lesson accompanying the story of Louis Braille, pupils are asked to list all of the problems they can which bother them, to select one of these annoyances which is most powerful, and are then led step by step to develop possible solutions for solving their problem. Similarly, one of the lessons accompanying the Franklin story lead pupils to observe for a 24-hour period the problems which bother other people and then to develop possible solutions for some of these problems.

14. Create Necessities for Creative Thinking.

It is a common saying that "necessity is the mother of invention" and certainly life-threatening emergencies and extreme conditions have been known to have stimulated much inventiveness. In one sense, this old saying is true because necessity is the need which initiates the creative or inventive process. The individual, of course, must react with the proper motivational intensity to the need. The experimental materials used in this project were designed in such a way as to create many situations which require children to do creative thinking. The Principal Investigator feels that he does this rather effectively in his graduate classes by requiring students to develop some new idea related to the course content. At all levels of education, the necessity for creative thinking can be created by making the problems assigned students sufficiently difficult in relation to the ability and experiences of the student. Obviously, a high level of difficulty cannot be maintained continuously, but occasionally all pupils should be confronted with problems which stretch their imagination and ingenuity to the limits.

The reports of those who have observed what goes on in a great variety of schools lead us to believe that this does not ordinarily take place. Coleman (1961), through his rather intensive studies of adolescent society in ten high schools, sensed in adolescents a desire to be more active and involved in the educational process. He found them manifesting orginality and passionate devotion to athletics, school newspapers, drama clubs, social affairs, and dates, but not in their school exercises, assignments, and tests. The latter apparently gave them little opportunity for this involved and passionate devotion. Bruner's observations of elementary schools are quite similar (1959). He describes his observations of a social studies class in a well-to-do suburb. Twelve-year olds were doing a "project" on the southeastern states. Each team was gathering facts that might end up on a map or chart. The fact-gathering was, as Bruner described, atomized and episodic. There was a list of the principal cities and products of Georgia, for example. Bruner asked then what they thought people would worry about in a place where the principal products were peanuts, cotton, and peaches.

The question was greeted as "unfair," because they were only gathering facts.

In preparing the planned experiences of this project, many provocative questions are posed and an effort has been made to supply the kinds of materials which will evoke from the children themselves many more provocative questions.

15. Provide for Active and Quiet Periods.

The provision of both active and quiet periods appears to be important in the production of new ideas and both should be included in planned, guided experiences. Important ideas occur to some people suddenly in the heat of various kinds of activities. The history of invention and discovery, however, shows that quiet periods of relaxation are also conducive of creative thinking. Repeatedly the bath tub, the bed, the church, and the like have been named as the birthplace of important new ideas. According to psychoanalytic theory (Schafer, 1958), regression in the service of the ego is necessary for creative thought. Others (Barron, 1958 , Rossman, 1931) have also emphasized the importance of subconscious or preconscious activity in producing new ideas. The child is not likely to be able to give way to his fantasy, wishes, and dreams, and produce imaginative ideas in a busy classroom of 30 to 40 active classmates. The teacher can, however, help the pupil plan periods of quiet and relaxation during the day. In some of the related activities in this project children have a chance to do some things alone and not have to participate with the classroom group all of the time. There are times when it is suggested that they read to themselves, write, draw, or construct.

Group response and stimulation can be valuable. Such school activities as dramatic play, music, and the like can also be important in bringing out creative ideas. In scientific discovery, rational teamwork and an interchange of ideas are useful in exploiting some results and in the improvement of new techniques. It seems clear, however, that fundamental discoveries arise from the efforts of a single person who is able to follow any fruitful paths suggested by his intuition.

16. Make Available Resources for Working Out Ideas.

It is obviously important that children have available the resources for working out some of their ideas. Otherwise, frustration and a feeling of purposelessness are likely to result. There is value in the excitement which comes from seeing the embodiment of one's idea in some concrete form or product. It is also important that teachers and group leaders utilize the resources of the community in encouraging creative thinking and in working out ideas. The public library, museums, farms, factories, recreational facilities, service institutions, government agencies, and churches can all play important roles.

It is equally obvious that schools and even communities will not be able to carry out all of their ideas. They need to be taught to accept creatively the unavailability of resources and to learn to improvise. It might be pointed out that there is an important difference between accepting limitations cynically and accepting them creatively.

This principle can be illustrated by three examples of responses from the item in one of our tests of creative thinking which requires the child to produce ideas for making a toy fire truck "more fun to play with" and dozens of opportunities for such activity occur in the materials created for this project. Some described elaborate and expensive hose arrangements for the fire truck. Others would say, "I could think of something if it didn't cost too much." Others will describe arrangments for using a piece of string or a stick as a hose. In the first example, the child is not hampered in his imagination by a lack of resources. In the second, he accepts limitations cynically and resists producing ideas. In the third, he accepts limitations creatively and uses the resources available to serve the purpose of having more fun.

It is quite reasonable to expect that children who do not have available the resources for working out some of their ideas or who are not taught to accept limitations creatively, will not develop their ability to elaborate. In a study in progress by Mrs. Patricia Will at the University of Minnesota of the creative thinking abilities of delinquent girls, one of the most dramatic findings is the inability of these girls to elaborate. Since many of them come from culturally and economically deprived environments, one could hypothesize that this deficiency has occurred as a result of the deprivation of resources for working out ideas and that the deficiency results in an inability to cope constructively with their life problems.

17. Encourage the Habit of Working Out the Implications of Ideas.

Often original thinkers fall far short of their potential achievement because they fail to follow through on their ideas and work out their full implications. As a result, their work may have obvious defects which could have been eliminated easily. Or, such individuals may fail to reach an important discovery just because they did not press their thinking far enough to carry an idea out to its logical conclusion. A child should begin learning early a willingness to follow through on ideas and do some of the tedious work of implementing or elaborating ideas. Later, he should develop a willingness to submit his ideas to the standard tests of science, art, literature, or the like. He must learn that this may take days, weeks, months, or even years, and that the process which he must follow may not be completely evident at any one time.

In many respects the organization of curricula and the pressure to "cover" standard bodies of knowledge serve as an obstacle to working out the implications of ideas. It is encouraging that many elementary schools tend to have relatively flexible daily schedules. Secondary schools and colleges which chop their curricula into standard five- and ten-week units have the most serious problems in this regard.

In developing instructional materials and in designing planned and guided educational experiences, two kinds of considerations have been introduced and both hold out excellent promise of making contributions to the development of sound types of learning and creative behavior. The first is a development which has come from the reading field and is reflected in the work of Durrell. Durrell and Chambers (1958) argue that one of the most important kinds of research in the field of reading will deal with the use of reading materials to encourage various kinds of elaborative thinking.

This would include: relating the content of reading to previous knowledge, producing illustrations and applications, providing opportunities for use, making relationships to other fields and various associations which integrate reading into knowledge and action. They predict that it will probably be found that well-designed exercises in elaborative thinking in reading will produce higher permanent retention and greater availability of knowledge to new situations. One of the strongest points of our experimental materials for fourth grade pupils may come from the attention given to the kind of elaborative thinking suggested by Durrell and Chambers.

Another consideration is derived from the value of having children think about a long problem. It is this consideration which influenced us to limit the rate of introducing the tape recorded materials to one every two weeks and to encourage permitting one thing to lead to another. Since such activities are time-consuming and may reduce the coverage of certain kinds of curricular content, there must be some important justification for their use. In the opinion of the Principal Investigator, the rationale given by Boraas (1922) some 40 years ago is still quite valid. He offered the following reasons for using long problems (pp. 193-195):

1. Children gain first-hand experiences with long problems in such a manner as to realize its nature and thereby be saved from attempting later to deal with long tasks as if they were like the little school tasks set from day to day.

2. They learn the strategies and techniques of breaking up a big problem into smaller problems by asking questions and structuring or restructuring it.

3. They learn to suspend their judgment until all of the evidence is in.

4. It gives an opportunity for cooperative thinking, demonstrates the value of such thinking, and shows ways and means of doing it.

5. The problem will serve as a nucleus for such valuable information which will be likely to remain with the pupils because the problem to which it is related will remain.

6. It will afford opportunity for gathering material under conditions quite similar to those of every day life.

7. It will give realistic practice in oral and written composition.

8. It will give opportunity for conflicts of opinion and debates, the purpose of which is discovering the truth.

9. It gives practice in organizing the information obtained into systematic wholes, evaluating the various parts and assigning to them their proportionate amount of space.

In analyzing the reports submitted by the teachers who used the planned, guided experiences constructed in this project, the Principal Investigator gained the impression that teachers rather generally failed to take advantage of this potentiality which we had tried rather carefully to build into the materials.

Thus, the matter of providing long thinking problems needs to be given additional study and experimentation.

18. Develop Habits of Constructive Criticism.

One study of the psychology of inventors (Rossman, 1931) led to the conclusion that an important difference between the inventor and the non-inventor is that the latter tends only to "cuss" the defects of his environment and the former tends to adopt the more constructive approach, "this is the way to do it." These two kinds of thinking are quite apparent even in first grade children. Some children can think of an almost endless number of defects in a toy, picture, or a behavior, but no constructive actions seems to occur to them. Many, for example, say that the toy dog should be able to move without suggesting how it could be made to move. Others would put wheels on it, tie a string to it, put a motor in it, put a battery in it, place a magnet in its nose, install a winding apparatus, and the like.

The extent to which the habits and skills of this type of constructive thinking can be taught must yet be demonstrated. It is easy to demonstrate, however, that instructions to read constructively research articles and textbook materials can produce markedly different results from out usual instructions. In three different experiments (Torrance, 1964a), students who assumed a constructive rather than a critical attitude toward available information were able to produce a larger number of solutions and more original ones. One of these experiments involved the reading of research articles and a second, textbook material. In both, one group was asked to read material with a critical attitude, thinking of other possibilities, applications, and the like. In the third experiment, information about an industrial problem was given to participants in an industrial training program. Critical and constructive attitudes were engendered in a similar manner with similar results.

In the opinion of the Principal Investigator one of the potential strengths of the experimental materials of this project lies in the opportunities they provide for constructive, imaginative evaluation and consideration of "the possibles."

19. Encourage Acquisition of Knowledge in a Variety of Fields.

The Principal Investigator had always thought that children in the early school years had a great diversity of interests, and rapidly shifted their interest from one thing to another. Our experience in testing and conducting experiments with children has convinced us that many children begin developing into "specialists" as early as the second grade. Although we have outstanding examples of achievement by such "one-track" minds, the history of discovery and invention shows that our great creative thinkers have been scholars and that a broad background of knowledge does not interfere with orginality of thinking. Knowledge outside and beyond one's special field is useful in generating original ideas. In fact, it seems that much of our pushing forward the frontiers of knowledge results when a specialist in one field borrows an idea or a technique from another field and applies it in his own. This diversity of interest and the right to explore new and potentially unpopular ideas lies at the base of problems of academic freedom.

At every turn, we have tried to permeate the materials developed for this study with a recognition that by its very nature, creativity makes it impossible to keep curricular areas separated. Thus, what begins as an art lesson may become a science lesson or vice versa. This in turn may lead to a history lesson or one in creative writing. Creative thinking involves the combination of divergent elements into new combinations and seeing new relationships. The materials constructed for this project attempt to establish the habit of letting one thing lead to another and an attitude of the relatedness of knowledge.

20. Develop Adventurous-Spirited Teachers.

The highly creative child will likely continue to feel estranged and inhibited in school, unless he has adventurous teachers who are willing to consider some of his wild ideas, help him to test and develop some of these ideas, and enjoy with him the development of his creative faculties. Less creative children will be even more inhibited in expressing their creative impulses. The adventurous-spirited teacher will impart that spirit to pupils and even the least imaginative child will probably become more creative. It is reasonable to expect that the teacher who is eager to explore the mysteries of the world about him will fill his pupils with the same desire to discover the new and explore the unknown. If the teacher is forever trying to find out the cause of things, pupils will be encouraged to do likewise.

One might think that instructional materials would have little or nothing to do with the development of adventurous-spirited teachers. A major objective of the materials, however, is to give support to the teacher's lagging spontaneity, boldness, and courage to try a different approach. The tape recorded dramas and lessons are designed to give the teacher this kind of boldness. If the audio-tapes succeed through the talents of the narrator and excellent actors in warming up the students, the teacher's tired harassed voice is not so likely to belie his lagging adventuresomeness. The teacher himself can be caught up into the boldness and enthusiasm of the narrator. It is to be hoped that in the process of using this adjunct, teachers will develop within themselves the resources which make it possible for them to teach in a more adventuresome spirit.

Description of the Materials

In the foregoing section, an attempt has been made to set forth the major elements in the rationale which guided the development of the instructional materials developed for use in this project. In this section, an attempt will be made to describe more specifically the materials, first in terms of general characteristics and then in terms of specific audio-tapes.

General Characteristics

Each of the twelve audio-tapes revolve about the role of creative problem-solving, the importanace of courage and other personality characteristics necessary for creative achievement, and planned, guided experiences in creative behavior. An effort is made to give the pupil intimate insights into the thought processes which enabled courageous men like Edison, Franklin, and the Wright Brothers to make important creative contributions. The audio-tapes were designed to help pupils and teachers "see first hand" how such explorers as Lewis and Clark and Richard E. Byrd applied courage and creative problem-solving processes to unlock some of the world's deepest geographical secrets through their ventures into the unknown.

In the fantasy series, one audio-tape tries to entertain and educate while pupils learn how a young, cowardly woodcutter conquers a towering giant by using his creative, imaginative powers and some newly-found bravery.

Each of the tapes is presented dramatically with appropriate sound and musical effects by a group of disciplined actors, narrators, and other talent. Creator and producer of the series is B.F. Cunnington, a former free-lance writer and graduate in journalism and radio speech. Principal script consultant was Miss Betty Girling, Director of the School of the Air at the University of Minnesota. Much of the documentary work was done by Richard Peterson and Karlo Mustonen, University of Minnesota graduate students. R. E. Myers, a former fourth-grade teacher and research assistant on the staff on the University of Minnesota Bureau of Educational Research and now on the staff of the College of Education of the University of Oregon, was the principal consultant on the lessons which accompany the tapes. Mrs. Pearl Buckland, a former fourth-grade teacher and a graduate student in elementary education, prepared most of the manuals or teachers guides and contributed many ideas for the lessons. Actual production was accomplished by the Educational Materials Center (EMC) Recording Corporation of St. Paul, Minnesota.

In preparing the scripts and teachers guides, much care was exercised to document the science, history, and geography tapes with fidelity to historical fact. As much as possible, primary sources were used as the basis for the materials created. Among the sources consulted were accounts written specifically for children. These materials were particularly useful in supplying ideas for the transmission of complex and advanced concepts written in terms which can be grasped and used by children. Accounts lacking historical accuracy, however, were avoided.

Efforts were made consistently to tailor the materials to the level of fourth-grade pupils without "talking down" to them. Vocabulary level and sentence structure was supervised closely by consultants with considerable experience in teaching fourth-grade classes. In some cases, however, the consultants were skeptical about the adequacy of the vocabularies of fourth-grade pupils and pilot tests were made with actual fourth-grade pupils. In many instances, children had no difficulty with words which the consultants thought were over their heads. In most cases, these were technical terms which have come into popular use during the lives of the pupils.

A variety of production techniques are represented by the audio-tapes. Some of them make use of the "stop-tape" device, whereby the teacher may shut off the machine at one or more climactic moments and then request the class to provide solutions to the problems being encountered. After the class has responded, the story may proceed to the conclusion, thus allowing the pupils to compare their responses with the recorded solution or solutions. Some of the solutions by pupils, however, may be more clever and effective than the recorded solution.

Although a detailed rationale of the purpose of the materials has been presented in the preceding section, it might be said in summary that the Great Moments of discovery series is designed to acquaint boys and girls with the nature of the creative process and the value of original ideas and to motivate them to behave in creative ways. The inclusion of the fantasy materials is based on the rationale that fantasy needs to be kept alive among children until their intellectual development is such that they can engage in sound types of creative thinking requiring the careful testing and modification of ideas. Its inclusion represents an attempt to offset, to some extent, an excessive quest for certainty, safety, objectivity, and the like so common among fourth graders.

Sounds and Images

The first of the audio-tapes presented was Sounds and Images, which served both as a test of originality and as a lesson in creative thinking. The tape consists of a set of sound effects repeated three times. The first sound effect is a rather simple, easily recognized, well-organized one but the succeeding ones become more difficult, stranger, and less obviously related. The fourth sound effect consists of six rather strange, relatively unrelated sounds which places a tremendous burden on the subject's ability to synthesize. Each time the sound effects are repeated, subjects are encouraged to let their imaginations go further and further and create more original and imaginative images or word pictures. Through specific instructions and the structure of the activity an effort is made to build into this tape such principles of creative thinking as: the warm-up, progressive warm-up, making divergent thinking legitimate, freedom from threat of evaluation, invitation to regress and enjoy the activity, freedom from inhibiting sets, and the like.

Upon the conclusion of this phase of the tape, pupils are encouraged to select their most interesting "image" or "word pictures" and to translate them into a painting, drawing, or story.

A second form of this audio-tape was used at the end of the field test as a kind of post-test. Both forms were administered to both the control and experimental groups. The measurement aspects of the tape will be discussed in the next chapter.

The Dog They Named King

"The Dog They Named King" begins with a lesson in creative writing which attempts to help children learn how to structure a story, become sensitive to the structure of fiction, and utilize a given structure in writing an original story. This lesson is followed by the recorded drama about a young prince and princess who face a haunted forest and a wicked witch to bring their pet dog to safety. One of the major aims of the drama is to inspire creative art productions. Some classes used the story as the basis of an original drama which they produced. Many other ideas are also suggested both for individual and group creative thinking projects. Emphasis is placed on the process of having children produce something and then create something new from what they have already produced.

Giovanni and the Giant

The drama of "Giovanni and the Giant" is an adaptation of the famous Italian fable by that title. Through encounters with a wicket giant, Giovanni employs cleverness, imagination, and boldness and thus develops from a frightened coward into a brave hero. Possible outcomes between fact and fantasy, tolerance for people different from oneself, awareness of the development of the character trait of courage in the hero, development of the ability to see new relationships and draw tentative conclusions from information given, and development of skill in making multiple hypotheses and in developing the full implications of an idea. At four points in the recorded lesson, the teacher is requested to stop the tape to allow the class to generate multiple hypotheses or possible solutions regarding the problems Giovanni encounters. A variety of ways of extending the thinking of pupils into various areas of the curriculum are offered.

Thus, the recorded materials may lead to lessons in character education, history, creative writing or dramatics, art, reading, political science, psychology, and the like. A suggested list of famous fantasies is provided in the teachers guide.

The Minstrel's Christmas

"The Minstrel's Christmas" was created as a means of stimulating children to write Christmas songs. In the heart-warming, dramatized story, an old man is made to realize that he is loved and needed by a song his grandchildren composed for a Christmas contest. The old man, the Minstrel, regains his self-respect and is reunited with his family. The story takes place in thirteenth century Netherlands and an attempt is made to stimulate interest in this period of history. Possible outcomes include: a realization of the value of capturing and working out the implications of hunches or germs of ideas, understanding that ideas for creative products do not spring full blown from the mind but frequently come in stages, and increased sensitivity to one's own reactions to the way things look, feel, sound, taste, and smell. In many classes, this activity led to a different kind of Christmas festival, a truly creative one bringing into play many of the creative arts -- music, poetry, dramatics, visual art, dance, and the like. It may also lead to lessons in medieval history, reading, botany, crafts, science, character education, and the like. Specific suggestions are offered in the teachers guide for each of these types of activities.

Trailblazer to the Stars

"Trailblazer to the Stars," the story of Robert Goddard, was presented as the first on the series of "Great Moments of Scientific Discovery." Goddard, American rocket pioneer, laid the scientific foundation for modern rocketry by courageously testing and developing his ideas about interplanetary travel. The story dramatizes many of the important problems of creative personalities. The drama presents ideas not only about the nature of the creative process and its value, but also about the problems the creative person must cope with and the kind of person he must be to press forward with new or unusual ideas. One of the possible outcomes of this unit is an understanding that the methods used by great scientists are similar to those used by fourth grade pupils in solving problems. Suggested activities lead pupils into the search for information about scientific advances, the development of original ideas, experimentation, the making and recording of scientific observations, creative writing and art work, and creative dramatics.

In the recorded lesson to accompany "Trailblazer to the Stars," the pupil is taken on an imaginary trip in a spacecraft. The drama suddenly halts when David, the youngest member of the team sent to find an earth-type planet, steps out of the spaceship into a "brand-new world to explore." The narrator suggests at the conclusion of the tape that the children write an ending to the story and then paint or draw an appropriate picture. A variety of other possible activities are listed in the teachers guide to implement the idea planned, guided experiences in creative thinking.

All-Around American

The drama of "All-Around American" presents selected accomplishments of Benjamin Franklin's scientific, inventive, journalistic and civic interests.

Possible outcomes include: the realization that a scientific concept of far-reaching importance may often be tested by simple apparatus, that there is value in research conducted purely to satisfy man's desire for knowledge, that useful inventions may result from knowledge obtained through experimental research, and that one's use of personal resources depends largely on his values, interests, and needs. This drama may lead to such activities as the writing of stories or plays concerned with Franklin's inventions or improvements, research into Franklin's diplomatic career, investigations of certain aspects of colonial life, creative writing, the preparation of greeting cards based on Franklin's sayings from "Poor Richard's Almanac," making up new morals for Aesop's fables, various kinds of experiments, and the like.

The recorded lesson leads the pupils into a planned, guided experience in making observations about problems, evaluating problems, and inventing solutions for the problems listed. This lesson usually results in an epidemic of inventions by children.

Master of Miracles

In "Master of Miracles," the inventive genius and dynamic energy of Thomas Alva Edison as both boy and man are highlited. Particular emphasis was placed on Edison's persistent search for the ultimate success in finding a satisfactory material for light bulb filament. Possible outcomes to be achieved through this set of materials include: an awareness of problems related to the one under immediate scrutiny, the generation of multiple hypotheses, the cultivation of the habit of testing hypotheses persistently until solutions are discovered, acceptance of the challenge of complex problems, and the cultivation of courage to propose untried ideas and to use independent approaches in solving problems. Numerous suggestions are offered for extending the recorded material and planned activities for deepening the pupil's understanding of the problems dealth with in the drama. Among the activities to which this drama may lead are: investigations into electrical wiring, reconstructing some of the simple inventions of Edison, creative writing, creative dramatics, art, reading, and the like.

The suggested recorded lesson is constructed around Edison's outstanding talent for combining two or more ideas to create something totally new and different. The recorded exercise involves the use of sets of two or more sound effects and pupils are supposed to guess what is happening. Pupils are then encouraged to combine in various ways the images which they created from the sounds. Illustrations are given to show how the ability to relate things and structure relationships can be used even in remembering. A variety of exercises are also suggested for using the ability to combine and recombine in color experimentation, mechanics, art, characterization, word games, and the like.

Eyes at Their Fingertips

The teachers guide for "Eyes at Their Fingertips," the story of Louis Braille, is contained in the appendix to illustrate more adequately the nature of the teachers guides developed in this project. The story of Louis Braille has a special appeal to fourth-grade youngsters because he was about ten years old when he started working on the idea of a better type of writing for blind children and had perfected the system by the time he was 15 years old.

This should help communicate to fourth-grade pupils that their ideas are important and that it will be they who will find the solutions to many of man's as-yet unsolved problems. The story illustrates the need for courage, sacrifice, endurance, and imagination. It illustrates the necessity for working out the details of an idea before it can be made useful and gain acceptance. The drama also describes some of the typical difficulties involved in gaining acceptance for new ideas.

The recorded lesson involves the development of codes and leads pupils into further studies of systems of symbols, coding and decoding procedures, and the like. A supplementary exercise, shown in the appendix, is an example of a planned, guided experience designed to get pupils to engage in the essential process Braille used in developing the system of writing for the blind which bears his name. Pupils are asked first to make an inventory of problems which worry them and then to pick out the problem which is most serious. They are then asked to define the characteristics of something needed to solve the problem. They are encouraged to build upon the prior failures of others and finally to work out a solution as completely as time and material resources permit. Possible outcomes include: the development of an understanding that inventors must be sensitive to their own needs and those of others, the realization that solutions may be arrived at gradually by utilizing past experiences and the knowledge of others or through a creative period in which experiences are reorganized into something new, acceptance of the need for working out the full implications of iedas, and the recognition that the ideas of children are frequently quite valuable.

Wings for the World

"Wings for the World" tells how Wilbur and Orville Wright pursued an interest persisting from boyhood and after years of experimentation and research built and flew the world's first successful, powered, heavier-than air flying machine. The possible outcomes of the unit include: the valuation of one's own unique, individual interests; recognition of the importance of intellectural and emotional openness to new ideas and experiences; respect for the ideas and activities which are different from one's own; and the development of the habit of allowing one idea to lead to another. The implications and extensions of the ideas developed may lead to further reading and research, character education, the study of transportation systems, writing stories, improving existing objects, or pursuing one's own keenest interest in some constructive way.

The recorded lesson involves a jungle survival adventure designed to encourage children to ask many, varied and meaningful questions; to develop the ability to generate diverse ideas, and to acquire the attitude that it is not always necessary or productive to push for one quick, simple answer. This in turn may lead to other activities in almost any curricular area.

Wizard on Wheels

The drama of "Wizard on Wheels" shows how Henry Ford's curiosity led him to invent new products and methods of production. The planned, guided experiences built into this set of materials were designed to encourage pupils: to value asking questions, to see that learning something new is exciting, to be aware of the value of flexible and experimental approaches to problem solving, to sense the implications of a given event, and to see how a basic idea can be elaborated and extended.

Suggestions are given for extending the story into an examination of a number of the problems created by Ford's invention and its implementation. Suggested individual creative activities might take a pupil into writing a play or poem about a trip to Detroit, writing a diary which might have been kept by Ford concerning his innovations and inventions, interviewing someone about their experiences with a Model T, and the like.

The recorded lesson is an exercise in which pupils are asked to decide whether each of ten sentences are reasonable or silly. It is hoped that pupils will generalize that: sound ideas may at first seem silly, not every statement can be answered by a simple "yes" or "no," and that a person should respect the ideas of others. The lesson is designed to encourage growth in ability to analyze statements, problems or situations; the habit of approaching the ideas of others constructively and with a positive attitude; and increased ability to tolerate ambiguity and to think in terms of possibles. Extensions of the idea might lead to finding elements of truth in familiar folk tales and myths, testing popular superstitions; creating a play, ballad, poem, etc. about a legendary folk hero, folk saying, superstition, or the like.

Captains of Courage

"Captains of Courage," which tells the story of Lewis and Clark's exploration of the West, belongs to the series on "Great Moments of Geographical Discovery." From the very beginning, it is a story of courage. It took the imagination and courage of Thomas Jefferson to envision what might lay beyond in the uncharted territory of our Great West. Of course, a number of Jefferson's hypotheses or guesses were incorrect. It took the courage of Lewis and of Clark actually to test Jefferson's hypotheses. Lewis and Clark had some hypotheses of their own but were careful to discard theirs and Jefferson's when the evidence was contrary. The drama suggests many possibilities for teaching the nature and value of the creative process, the attitudes necessary for discovery of the new, and the importance of courage. The story presents natural opportunities for investigations into map making and the development of map making skills. Additional suggestions are given for guided, creative activities in practically every aspect of the elementary school curriculum.

In addition to the map-making lesson, there is a recorded weight-guessing exercise designed to teach experimental method. This planned, guided activity is designed to teach pupils to: make use of pertinent clues in making "educated guesses," feel the need for testing systematically one's ideas, extend the practice of making and testing hypotheses to many areas of the child's life, and to use experimental procedures in solving problems.

Polar Pilot

At three points in the taped drama, "Polar Pilot," pupils are asked to offer possible solutions to problems which Richard E. Byrd and his crew actually faced in making exploratory flights over the Arctic and Antarctic. The planned, guided experience built into this unit are aimed to encourage pupils to learn to: make creative use of imposed limitations and available resources, feel the enjoyment of being challenged by a complex situation, extend ability to entertain simultaneously many possibilities, and be more aware of the importance and power of ideas in controlling and modifying the environment.

The drama may be used to encourage further investigations concerning the Polar regions today, the making and checking of hypotheses concerning problems commonly faced by explorers in the Polar Regions, and how men have survived in the Polar Regions.

The recorded lesson invites the listener to engage in an experiment in the art of observation. He is asked to select some commonplace object which he passes every day on his way to school, to note its height, breadth, color, and over-all design. He is then asked to reproduce the object in some medium when he arrives at school. It is suggested that the pupil repeat this process of observing and then recording his impressions during the next two years. With each succeeding observation, he is expected to learn more about the object and gain a deeper appreciation of its nature. This and other similar activities are planned to achieve such outcomes as increased awareness of the beauty and wonder of the world, increased understanding of the character of familiar objects, increased sensitivity to the inherent structure of objects, and fuller use of one's senses.

Summary

In this chapter, an effort has been made to describe how the staff of the Bureau of Educational Research went about developing the audio-tapes and teachers guides which constituted the planned experiences in creative thinking developed through this project. An analysis was made of the task to be achieved in creative growth among fourth-grade pupils. To increase the chances that the materials would be appropriate to the fourth-grade curricula, possible titles were submitted to fourth grade teachers and supervisors especially interested in creative development. Titles were selected on the basis of the data yielded by a questionnaire completed by such persons. On the basis of what is known about the creative process and the conditions which favor creative growth a set of 20 guiding insights or hypotheses were set forth in such a way as to show how such insights have been built into the materials developed in this project. Brief descriptions were given of the units developed for this project, again showing how the insights from research on creative thinking were used in constructing materials and ideas for planned, guided experiences in creative thinking.

Chapter 3

INSTRUMENTS USED IN EVALUATING OUTCOMES

Just as we were anxious to build into the instructional materials constructed for this project the best that we know about creativity, we were anxious to use assessment devices which have built into them the best that is known about the creative process, the creative person, and creative products. Fortunately, several instruments already developed by the Principal Investigator were available for assessing certain types of creative growth of interest in this project. The development of a completely adequate set of instruments to assess the outcomes discussed in Chapter 2 will require a great deal of additional time and resources. The evaluation program, however, was built around the major objectives of the project: to determine whether or not the use of the series of audio-tapes in the fourth grade will contribute to the elimination of the slump in creative development and will result in greater creative growth and excitement about learning than in control classes without sacrificing traditional kinds of achievement.

In the original plans for the project, it was hypothesized that fourth-grade pupils under the experimental conditions compared with those under control conditions will:

1. Show greater growth as measured by a set of pre- and post-tests of creative thinking.

2. Like school better and find it more exciting.

3. Participate in more creative activities on their own.

4. Show as much growth in basic educational skills, as measured by a battery of standardized achievement tests at the beginning and end of the experimental period.

In addition, it was hypothesized that teachers using the experimental materials would be more successful than their colleagues at the end of the school term in differentiating between the most and least creative pupils in their classes. It was also hypothesized that pupils in the experimental classes would choose less commonplace and more creative occupations than their peers in the control classes.

A brief description will be given of each of the assessment devices used in the study.

Abbreviated Form VII of the Minnesota Tests of Creative Thinking

Abbreviated Form VII of the Minnesota Tests of Creative Thinking was especially designed for use in this project. It consists of four of the creative thinking tasks developed earlier by the Principal Investigator (1962a).

It was desired that the battery for use in this project tap as many different kinds of creative thinking ability as possible, yet be brief and simple to administer. Each of the four tasks requires ten minutes and the test booklet contains all of the materials needed to generate ideas. The general instructions to pupils encourage them to use their imagination, to think of unusual, interesting, and exciting ideas -- something no one else in the class will think of. They were instructed to make good use of their time and to work rapidly without rushing. Pupils perform the test in groups and record their own answers in the test booklets.

The four tasks selected had been found through earlier research to assess somewhat different aspects of creative thinking and to have satisfactory reliability and validity. Two of them are primarily non-verbal and figural while the other two are chiefly verbal, making it possible to study growth in both verbal and non-verbal kinds of creative thinking. Even the two non-verbal tasks, however, attempt to engage different kinds of creative thinking abilities. The Incomplete Figures Test requires the subject to give structure, integration, and synthesis to the incomplete, unrelated, and unorganized. The Circles Test, on the other hand, requires the subject to disrupt and to destroy something which is already complete to give it a new form. Responses to each of the four test tasks are scored for fluency, flexibility, originality, and elaboration by methods developed through earlier research.

Incomplete Figures Test

The Incomplete Figures Test is an adaptation of the Drawing Completion Test developed by Kate Franck and described by Frank Barron (1958, 1963). It consists of ten incomplete figures, each of which is to be completed by adding lines (not necessarily straight lines) so as to sketch some interesting object or picture that "no one else will think of." Subjects are instructed to make each picture tell as interesting and as complete a story as possible by building upon the initial ideas. Subjects are also asked to make up original titles for each picture. The basic rationale of the test is based on the theory from Gestalt psychology that holds that an incomplete figure sets up within an individual tensions to complete it in the simplest and easiest way possible. This implies that to produce an original (uncommon) response, a subject must control his tensions and delay gratification of this impulse to closure long enough to permit a mental leap.

The *fluency* score is obtained by counting the number of figures completed during the ten- minute period. The maximum score, therefore, is ten.

The *flexibility* score is obtained by counting the number of different categories into which the responses fall. Both the drawing and its title must be used in determining the category. The scoring guide contains a list of 70 empirically derived categories into which 99 percent of the responses given by a sample of 1,056 subjects from kindergarten through the college years could be classified. Additional credit is given for responses falling outside these 70 categories.

To obtain the *originality* score, each response is considered individually with the use of a scoring guide for each of the ten figures.

Depending upon the statistical infrequency of the response in the standardization sample, a value of zero, one, or two points may be assigned. A score of zero is assigned to responses given by five percent or more of the 1,056 subjects used in developing the guide. Similarly, one-point responses are those produced by two to 4.99 percent of that sample. All other responses receive two points, provided they show "imagination and creative strength and fall within the realities of the task."

Two assumptions underlie the scoring of this test for elaboration. The first assumption is that the minimum and primary response to the stimulus figure is a single response. The second is that integration and exposition of detail is a function of creative thinking. Therefore, in scoring for elaboration, credit is given for every pertinent detail (idea) added to the original response, to its boundaries and/or to the surrounding space. However, the basic response itself must be meaningful before elaboration has any worth, or can be scored. The scoring guide provides detailed information about what constitutes scoreable details or ideas.

The Circles Test

The Circles Test consists of seven rows of circles with one-inch diameters. The page containing the instructions has two rows of three circles each and a second page contains five rows of five circles each. The Circles Test is designed to provide measures of four types of divergent thinking: fluency ("see how many objects or pictures you can make"), flexibility ("make as many different kinds of pictures or objects as you can", originality ("try to think of things that no one else will think of"), and elaboration ("put as many ideas as you can in each one and make them tell as complete and as interesting stories as you can"). Subjects are also asked to give each object a title. The circle must be a major part of each object or picture sketched.

In scoring the Circles Test, repetitions and irrelevant responses are eliminated and given no credit. For this purpose, a relevant and scoreable response is defined as one which contains a circle as an integral part. The fluency score is the number of relevant responses minus the number of duplications. The flexibility score is the number of different categories into which a subject's responses can be classified. The scoring guide contains 34 empirically derived categories which account for over 98 percent of the responses given by 588 subjects from kindergarten through the college years. Unclassified responses, which are relatively rare, receive one additional point each. The originality score is based on the statistical infrequency of the response among the same 588 subjects who contributed the data for the flexibility categories. Responses are listed alphabetically with weights ranging from zero to plus two -- zero for responses given by five percent or more of the subjects, one point for those given by from two to 4.99 percent, and two points for responses given by less than two percent of the subjects. Each unlisted response showing creative strength is also assigned a weight of two. The principles and the actual practice for arriving at the elaboration score are the same as those stated in the case of the Incomplete Figures Test. Thus, the elaboration score on an object is the number of different ideas communicated by that object, in addition to the minimum basic idea.

Product Improvement Test

The stimulus material for the Product Improvement Test includes a sketch of a stuffed toy dog. Subjects are asked to list "the cleverest, most interesting and unusual ways" they can think of for changing the toy dog so that children will have "more fun playing with it." They are urged to free themselves of cost considerations. This task has proved to be one of the most dependable verbal tests of creative thinking with a high degree of face validity. It encourages subjects to "regress in the service of the ego" and to play with ideas which they would not dare express in a more serious task.

The fluency score of a subject is the number of relevant and separate responses or ideas given, where relevancy is judged in terms of whether a response tells us how the toy dog could be changed so as to make it more fun to play with. The flexibility score is the number of different principles or approaches out of 20 given in the scoring guide. These approaches or categories exhaust almost all of the possibilities by which a product, process, organization, or plan can be improved. As in the case of the two preceding tasks, weights ranging from zero to two are assigned to responses. In this case, the responses of 594 subjects from grades one through twelve were analyzed in determining the weights. The general rationale for determining the elaboration score is also essentially the same as in non-verbal tasks. It reflects the extent to which the idea is spelled out or elaborated and is obtained by counting the details over and above what is necessary to communicate the basic idea.

Unusual Uses of Tin Cans Test

The Unusual Uses of Tin Cans Test is a modification of Guilford's Brick Uses Test (Guilford, Wilson, Christensen, and Lewis, 1951). The Principal Investigator discovered through pilot studies involving several alternatives that "tin cans" elicits a wide range of responses and provides much interesting information about the thinking of children. Subjects are asked to list as many interesting and unusual uses as they can think of for tin cans, without limiting the size, quality, or number of cans to be used. The task requires a person to free his mind from the well-established and rigid set of thinking about a tin can in terms of its function as a container. The inflexible mind seems to be unable to think of other categories of response, in spite of the fact that he knows he is supposed to think of "unusual uses." The scoring follows essentially the same pattern as described for the other three tasks.

Reliability

Little difficulty has been experienced in maintaining adequate interscorer reliability for the four tasks included in this battery. Yamamoto (1962), for example, reports the following coefficients of interscorer reliability for three of the four tasks included in this battery:

Product Improvement:	Fluency	1.00
	Flexibility	.87
	Originality	.98
	Elaboration	.99
Unusual Uses (Tin Cans):	Fluency	1.00
	Flexibility	.84
	Originality	.98
	Elaboration	.99

Circles:	Fluency	1.00
	Flexibility	.91
	Originality	.98
	Elaboration	.98

The Incomplete Figures Test was not included in Yamamoto's battery. Interscorer reliabilities for the Incomplete Figures Test, however, have consistently been in excess of .90.

The four tasks included in this battery have been used extensively in test-retest reliability studies. Mackler (1962), using three testings and three alternate forms of the Unusual Uses Test, each separated by a two-week interval, obtained reliabilities of .61, .62, and .71 for fluency, flexibility, and originality between the first and second testings; .75, .74, and .66 between the second and third testings; and .65, .71, and .60 between the first and third testings. Yamamoto (1962) obtained reliabilities of .75, .60, .64, and .57 for Unusual Uses of Tin Cans with college seniors with an interval of 10 weeks between testings for fluency, flexibility, and elaboration.

Yamamoto (1962b) also obtained test-retest reliabilities of .69, .64, .61, and .75 on the Product Improvement Test for fluency, flexibility, originality, and elaboration using the toy dog in one instance and the toy monkey in another. Rouse (1963), using the Product Improvement Test (dog/monkey) with 31 mentally retarded youngsters with an elapsed interval of about six months obtained reliabilities of .85, .76, .68, and .60.

The Circles Test has also been subjected to several test-retest reliability studies. Yamamoto (1962), in the situation already specified, obtained reliabilities of .76, .63, .79, and .67 for fluency, flexibility, originality, and elaboration, with identical forms of the Circles Test. Similarly, Grover (1963), testing and retesting 101 ninth-grade students after an interval of one week, obtained a reliability of .69 on the Circles Test. Mackler (1962), in the triple testing situation already outlined, used the Circles, Squares, and Parallel Lines Tests. He obtained reliabilities of .72, .60, and .63 for fluency, flexibility, and orginality between the first and second testings; .65, .62, and .81 between the second and third testings; and .47, .60, and .57 between the first and third testings.

Since the Incomplete Figures Test used in Abbreviated Form VII combines four figures from what had been known as Form B with four from Form A, no appropriate data were available for this task. Split-half reliabilities of .88, .85, .85, and .92 were obtained by Gowan (Torrance and Gowan, 1963) for fluency scores of third, fourth, fifth, and sixth grade pupils. The Principal Investigator also obtained a reliability coefficient of .80 for the total score for a group of 50 students in an arts and science camp, ranging from fourth through ninth grade, and tested about ten days apart.

Validity

No validity studies are yet available for the particular combination of tasks used in Abbreviated Form VII. The tasks are identical, however, to those which have constituted the bulk of our validity studies and it is reasonable to expect similar results with this form. Thus, these studies will be summarized here briefly.

In the original designing of the test tasks, instructions, and scoring systems, we have endeavored to build into them characteristics which make use of the best that we know about the creative processes as they have been revealed in the history of invention, discovery, and other kinds of creative achievement, as well as the results of experiments such as Maltzman's (1960), Gordon's (1961), and others. Most of the attempts to establish some type of validity for these measures have involved one or the other of the following two approaches:

1. Identifying high and low groups on some test measure and then determining whether or not they can be differentiated in terms of behavior which can be regarded as "creative."

2. Identifying criterion groups on some behavior regarded as creative and then determining whether or not they can be differentiated by test scores.

Using the first procedure, we found at the elementary school level that children who achieved high scores on the tests of creative thinking also initiated a larger number of ideas in small-group problems involving creative problem-solving than did their less creative peers. When matched for intelligence, sex, race, and teacher, the most creative children proved far more frequently than their controls to have reputations for having wild or fantastic ideas, to produce drawings and other products judged as original or as "off the beaten track," and work characterized by humor, playfulness, relative lack of rigidity, and relaxation. Weisberg and Springer (1961), using the Circles, Unusual Uses of Tin Cans, and the Ask-and-Guess Tests with gifted (high IQ) fourth graders, compared the most creative with the least creative. Through psychiatric interviews, the highly creative children were rated significantly higher on: strength of self-image, ease of early recall, humor, availability of Oedipal anxiety, and uneven ego development. On the Rorschach Ink Blots they showed a tendency toward unconventional responses, unreal percepts, and fanciful and imaginative treatment of the blots. Their Rorschach responses described them as being both more sensitive and more independent than their less creative peers.

Using this same approach, a group of high scoring general business teachers were found to behave dramatically different in the classroom from a group of their less creative peers. They asked more questions, asked a greater variety of kinds of questions, gave more illustrations of key concepts, interacted more with their students, and the like.

Through numerous partial replications of the Getzels and Jackson (1962) studies, it has also become clear that tests of creative thinking like those included in Abbreviated Form VII and tests of intelligence or scholastic aptitude identify different types of individuals. The ways in which they are different describe those high on the measures of creative thinking in ways which might generally be regarded as "creative." They are seen by their teachers as less desirable as pupils, as more difficult to get to know, and as more playful and less ambitious. They choose occupations which are regarded as unconventional or rare and express values which are different from their teachers.

Using the Minnesota tests, Fleming and Weintraub (1962) obtained a coefficient of correlation of -0.41 (significant at the .01 level) between six of the verbal tasks and a measure of rigidity, a construct defined in terms of inflexibility, stereotypy, intolerance of ambiguity, and a compulsive need for order.

Using the approach of identifying criterion groups regarded as highly creative or non-creative, several encouraging bits of validity evidence have been accumulated. Children nominated by their teachers on various criteria of creative thinking, curiosity, and the like, achieved higher scores on the test of creative thinking than did their peers not so nominated or nominated as being especially low on the criterion in question. Above the third grade, pupils receiving a large number of peer nominations on various criteria of creative thinking achieved higher scores on the tests of creative thinking than did those who received no nominations. At the high school level, the best validity evidence comes from peer nominations, especially if we use the same criteria in asking for nominations that we use in scoring the tests, i.e., ideational fluency (nominating those having a large number of ideas), flexibility (nominating those using a variety of approaches or strategies), originality (nominating those having unusual, surprising, off-the-beaten-track ideas), elaboration, and the like.

At the college level, indications of validity have come from original-idea projects, scores on subject-matter tests requiring creative problem-solving, self-initiated learning, and from faculty nominations in a technical college where there are numerous opportunities for creative achievements of various kinds.

Highly productive saleswomen in a large department store (Wallace, 1961) scored significantly higher on a battery of creative thinking tasks (including Circles, Product Imporvements, and Unusual Uses) than did their less productive peers in the same department.

Sounds and Images Test of Originality

The dual-purpose Sounds and Images recording has already been described in Chapter 2. It can be used both as a test of originality and as a warm-up device for creative art and writing activities. As already indicated, it has built into it several conditions which facilitate the operation of the creative thinking process. Approximately one-half of the subjects were administered Form I as a pre-test and Form II as a post-test and the other one-half were administered Form II as a pre-test and Form I as a post-test. The instructions and structure of the test task make use of the principle of progressive warm-up, invitation to regress, the legitimacy of divergent responses, and freedom from inhibiting sets.

The audio-tape consists of four sound effects, each of which is repeated in sequence three times. The sound effects range from simple to complex, from commonplace or familiar to unusual or strange. Administration as a test takes 18 minutes. (Teachers can allow whatever time they desire for the creative art or writing inspired by the experience, but this is not of concern in the assessment program.) Subjects record their responses on a sheet which has a 3 X 4 layout with three rows for the three repetitions and four columns for the four sound effects. Each repetition of a sound effect is followed by a brief pause for the subject to record in the appropriate rectangular spaces the word picture each sound effect suggests.

To provide a measure of originality, a scoring guide has been developed on the basis of the responses of 544 subjects on Form I and 169 for Form II. A scale ranging from zero to four is used: 0 for responses which occured in 5 per cent or more of the records; 1 for those occuring in from 3 to 4.99 per cent of the cases; 2 for 2 to 2.99 per cent of the cases; 3 for 1 to 1.99 per cent of the records, and 4 for those not listed in the categories included in the guide but having creative strength.

With the use of the scoring guides, interscorer reliabilities have been in excess of .90 but no data are yet available concerning test-retest reliability.

Imaginative Stories Test

Two different forms of the Imaginative Stories Test were used, one as a pre-test and the other as a post-test. In each form, ten topics are given, and subjects are asked to choose one of them and to write the most interesting and exciting story they can think of about that topic. Subjects are asked not to be preoccupied about their handwriting, spelling, neatness, and the like. Instead, they are asked to use their energy to put as many good ideas as they can into their stories. A time limit of twenty minutes was used in the administration of the test. A list of the two sets of titles and the instructions are shown in the appendix.

All of the titles involve an animal or a person who possesses some divergent characteristic or manifests some kind of divergent behavior. This was deliberate as we were interested in investigating also the ways in which children value divergency and how children perceive their society's pressures against divergency. As we had planned and as was demonstrated in earlier studies, the titles appealed to the interest and imagination of the subjects. In fact, a subject is practically compelled to create or imagine in order to produce a story about the titles suggested. Very few recalled stories from their own experiences.

The instructions for the writing of the imaginative stories were designed to encourage originality and interest. No ready-made scales for evaluating either of these characteristics could be located at the time the study was conducted. Thus, the relevant literature was surveyed in an attempt to determine what characteristics of compositions had been considered by others in rating them on originality and interest. These were then listed and nine characteristics for each were selected as being appropriate for relatively objective scoring. Most of the criteria for Interest were obtained from the work of Flesch and his associates (Flesch, 1948; Flesch and Lass, 1955). The others were gleaned from a variety of sources (Colvin, 1902; Hinton, 1940; Applegate, 1949).

Originality

In determining the Originality score, the following nine points or characteristics are considered and one point is given for the occurrence of each in the story.

1. Picturesqueness: Writing may be said to be picturesque if it suggests a picture, is colorful, is strikingly graphic, or is objectively descriptive.

2. Vivid: A vivid story is told with liveliness and intenseness. The description is so interesting, or even exciting, that the reader may be stirred emotionally. It is vigorous, fresh, alive, spirited, lively.

3. Flavor: A story may be said to have flavor if it possesses a noticeable, characteristic element, or taste, or appeals to the sense of taste, smell, touch, etc.

4. Personal Element: A story may be rated as having the personal element if the author involves himself in the account or expresses his personal feelings or opinions about the events described.

5. Original Solution or Ending, Surprising: What we are looking for here essentially is the "punch line." It need not be funny, though it may, but it must be unexpected, unusual, surprising.

6. Original Setting or Plot: This category is scored if the setting, theme, or plot is unusual or original, unconventional, new.

7. Humor: Stories are scored for humor if they have the quality of portraying the comical, the funny, the amusing. One simple criterion would be to score a story for this category if it makes the rater laugh or smile. This is not altogether dependable, however, when one is rating a large number of stories at a single sitting. Thus, it is useful to take clues from the works of some of the better known humorists: bringing together certain incongruities which arise naturally from the situation or character, so as to illustrate some fundamental absurdity in human behavior or character.

8. Invented Words or Names: When parts of two or more words are combined to express some concept, when animals and persons are given amusing names or names appropriate to their character, or the like, credit is given in this category.

9. Other Unusual Twist in Style or Content: This category was added primarily for the purpose of giving a bonus credit for a high type of originality not adequately reflected in the eight foregoing categories.

Interest

1. Conversational Tone: Many children tell a story just as though they were carrying on a conversation with the reader. Others write more formally and thereby spoil the reader's interest.

2. Naturalness: Usually, but not always, stories written in a conversational tone are also "natural." The conversation, however, may be stilted and artificial; it might still be "conversational in tone" but not "natural." A story may also have naturalness without being conversational.

3. Use of Quotations: A score for "use of quotations" is given whenever the direct words of the speaker are given. Many children in the early grades (third and fourth) have not been taught to use quotation marks, although some use them without being taught. Thus, credit is given whether quotation marks are used or not. Almost all stories credited with "use of quotation marks" have a "conversational tone." Many having a "conversational tone," however, do not use quotations.

4. Variety in Kind of Sentence: Two types of variety or kind of sentence can be considered and either gives credit in this category. (In one study, it was decided to give a point for each kind of variety.) Sentences may vary according to use: declarative, interrogative, exclamatory, etc. They may also vary according to form: simple, compound, complex, and compound-complex. In a short story (under 150 words) any variation of either type qualifies the story for credit. In longer stories, there must be three or more variations in form and/or use.

5. Variety in Length of Sentence and Structure: If there is a mixture of short and long sentences this category is scored. Also credit is given for any variation in the structure of sentences, such as predicate before subject, dependent clause before independent clause, and the like.

6. Personal Touch: Same as "personal touch" under "Originality."

7. Humor: Same as "humor" under "Originality."

8. Questions and Answers: Two types of question-and-answer techniques are scored for this category. There may be questions and answers in the direct quotations of speakers. Or, the writer may ask the reader a question and then answer the question. Either is scored for this category.

9. Feelings of Characters: If the feelings of characters in the story are given either through their own words or through the writer, this category is credited.

Reliability of Scoring

Three judges were involved in the initial determination of inter-scorer reliability. The scoring task was new to all three judges, but Judge A was an established research worker with more than three years' experience in creative thinking research. Judge B had had only two months' experience with creative writing projects, while Judge C had had no training whatsoever when he was asked to perform the judging task.

The following interscorer reliabilities resulted:

Judges	No. Records	Originality	Interest
A and B	25	.88	.84
A and C	30	.84	.82

Relationship With Other Measures of Intellectual Performance

With a class of 20 fifth graders and one of 20 sixth graders the following coefficients of correlation were obtained between these two measures and other measures of intellectual performance:

Measure	Fifth Grade Originality	Fifth Grade Interest	Sixth Grade Originality	Sixth Grade Interest
Composite Measure of Creative Writing	.65*	.70*	.80*	.72*
Total Score on Form D, Creative Thinking Test	.49*	.53*	.51*	.45*
Mental Age (Stanford-Binet)	.44*	.29	.44*	.30
Reading Achievement (Iowa)	.63*	.58*	.26	.32
Study-Work Skills (Iowa)	.54*	.44*	.40	.41
Language Skills (Iowa)	.61*	.57*	.37	.13
Arithmetic Skills (Iowa)	.60*	.52*	.57*	.32*

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*Significant at the .05 level of confidence or better.

How I Like School Inventory

"How I Like School" is an untimed inventory, answerable by encircling either "Yes" or "No" on the inventory itself. It consists of 50 rather straightforward questions such as:

"Do you like school?"

"Is your school room a happy place?"

"Are you afraid to ask questions?"

"Do you hate school?"

(The complete inventory is included in the appendix.)

Subjects were asked not to write their names or other identifying information on the instrument. Arrangements were made for them to deposit completed inventories in a large envelope to insure confidentiality, to elicit frank responses and to minimize faking. In spite of these precautions, it was difficult to keep teachers from observing what responses their pupils were making.

Where this occurred, the examiner asked the teacher to come into the hall so that he could explain the reasons for confidentiality. The questionnaire was originally developed by Professor Cyril J. Hoyt as one of the instruments used in validating the Minnesota Teacher Attitude Inventory. Scoring is accomplished by giving one point for each response indicating a favorable attitude concerning school.

Creative Activities Checklist

Two checklists of creative activities were developed for use in this study. We were anxious to determine what influence the instructional materials and their use had on the stimulation of self-initiated creative activities outside the curriculum. Since children usually have more time free for initiating creative activities during vacation periods, one checklist was designed for use immediately after the Christmas vacation and the other immediately after the summer vacation. With the assistance of several fourth-grade teachers, fifth-grade pupils, and parents, an attempt was made to include a wide variety of creative activities within the interest level and range of fourth-grade children. The Christmas checklist consists of 135 activities with space for listing activities not included in the checklist itself. Included are such items as:

Made artificial Christmas flowers

Designed, made, and sent Christmas greeting cards

Figured out a new skating trick

Made up puzzles (crossword, jigsaw, anagrams, etc.)

Wrote a play.

The summer checklist consisted of 225 items such as:

Listened to sounds of summer such as water lapping on the shore, birds singing, leaves rustling, etc.

Wrote a poem or story about the sounds

Made a picture or a drawing about the sounds

Built a house for a pet

Made up clues for a treasure hunt.

Complete copies of both checklists are included in the appendix. Scores were obtained by counting the number of activities checked and listed.

Achievement Tests

Iowa Tests of Basic Skills

The Iowa Tests of Basic Skills are well-known standardized tests of educational achievement authored by Lindquist and Hieronymous and published by Houghton Mifflin Company. These tests have been reviewed rather extensively by Buros (1959). Different forms of the test were used for pre- and post-tests in the Minnesota and South Dakota studies. Five different scores are provided: vocabulary, reading comprehension, language skills, work-study skills, and arithmetic skills. These tests attempt to provide measures of general educational development or generalized intellectual skills rather than subject matter knowledge.

California Achievement Tests

In the study conducted in Georgia, the California Achievement Tests rather than the Iowa tests were used. These tests were authored by Tiegs and Clark and are published by the California Test Bureau. They constitute a battery which yields the following scores:

Reading Vocabulary, Reading Comprehension, Reading Total

Arithmetic Reasoning, Arithmetic Fundamentals, Arithmetic Total

Mechanics of English, Spelling, and Language Total

Battery Total

The battery used in this study was the one for grades four through six. It requires three hours of testing time and the reported reliabilities range from .79 to .95. Norms were derived from a representative national sample.

Teacher Nominations Blank

The Teacher Nominations Blank was used at the end of the study to obtain from each teacher (both experimental and control) judgments concerning the most and least creative pupils in their classes on four different criteria, namely, fluency, flexibility, originality, and elaboration. For the guidance of the teachers, the four criteria were defined briefly. (See appendix for complete copy of the form used.)

The most fluent pupils were defined as those who seemed to be "just running over with ideas," though not always the most talkative. Those most flexible in their thinking and production of ideas were described as coming up immediately with different approaches when one idea fails, employing a variety of strategies and approaches in solving problems, and readily abandoning unproductive approaches without abandoning the goal. The subjects who are most original in their thinking were defined as those who are able to get away from the obvious and commonplace, to break away from the beaten path, see relationships not seen by others, and produce ideas which are different from those presented by others in the class or found in the textbooks.

Elaborators were described as those who are able to take an idea or a task and spell out the details, who are able to make a simple idea attractive and fanciful, and who are able to work out the plans for a project or activity.

Teachers were asked to nominate five pupils judged to be highest and five judged to be the lowest on each of these four criteria.

Teacher Reports on Audio-Tapes

The Teacher Report on Audio-Tapes form is an open-ended questionnaire, designed to elicit the reactions and observations of the teachers and, through them, the reactions of their pupils, to the audio-tapes and the lessons accompanying them. (See copy of questionnaire included in the appendix.) The form included blanks for responding to the following questions:

How did your pupils react to the story?

Which single pupil seemed to show the greatest interest? In what way?

What did you feel was the most effective element in the dramatization?

How did your pupils react to the lesson which followed the dramatization?

Was the lesson suitable for your pupils in both lesson content and level?

What kinds of learning experiences or activities resulted, directly or indirectly, from the playing of the tape?

Do you have any suggestions as to how the tape might be made more educative for your class?

Each teacher in the experimental group was requested to complete one of these forms for each audio-tape shortly after the unit was completed. An analysis of these reports will be presented in Chapter 4 as a part of the study procedures.

Chapter 4

EXPERIMENTAL PROCEDURES

Subjects

The population studied in this project consisted of fourth-grade pupils enrolled in public schools. Field tests were established in three different localities to avoid the risk of capitalizing on chance and local variations and to make possible comparisons among school systems. In all three localities, all reasonable efforts were made to insure that the composition of the control and experimental groups was similar in size, ability level, racial, and socio-economic characteristics. There were no statistically significant differences in the mean scores of the experimental and control groups on any of the achievement test scores available at the beginning of the study.

Minnesota Field Test

The largest-scale field test was established in the Richfield, Minnesota, School System. Thirty of the 31 fourth-grade teachers were placed in the experimental and control groups by random methods. The other fourth-grade teacher conducted advanced or pilot tests with some of the experimental materials and was not included in the study sample. Present for testing at the beginning of the experiment were 400 pupils in the control groups and 400 in the experimental groups. A total of 379 of the controls and 398 of the experimentals were available for testing at the end of the study.

Richfield is an immediately adjacent residential suburb of Minneapolis with a population of 42,523 in 1960. It won an All-America City Award in 1954 for handling problems of population growth. Its population increased 10 times within a period of fifteen years during which a century-old farming community was transformed into a city following World War II.

Most of the elementary schools in Richfield are relatively modern and well-equipped. All had tape recorders as a part of their regular equipment. The elementary department of the school system has what are called "helping teachers" at both the primary and intermediate levels. Both of these teachers, as well as the elementary superintendent, were quite interested in the project, offered many suggestions during the development of the materials, and worked with the teachers in the experimental groups in adapting the experimental materials to their curriculum. It should also be said that the helping teachers had been working with their fellow teachers for some time to develop more creative ways of teaching. Thus, the control teachers also had considerable stimulation in the direction of more creative teaching.

Of the 388 fourth-grade boys for whom vocational choice data were obtained, 57 (about 15 percent) expressed a preference for careers as professional athletes. (The Richfield suburb is very close to Metropolitan Stadium, the home of the Minnesota Vikings football and the Minnesota Twins baseball teams.) Other popular vocational choices among boys were: scientist, 41; pilot or astronaut, 40; medical doctor, 31; engineer, 29;

artist, cartoonist or designer, 19; military, 15; teacher, 14; operator of bulldozer, tractor, truck, etc., 12; salesman, 10; mechanic, 9; lawyer, 9; police detective, 9; manual laborer, 9; and carpenter, 8.

One hundred and twenty-eight of the 361 girls expressing a vocational choice chose teaching and 83 chose nursing. Other popular choices among the girls were: veterinarian, 22; secretary, typist, etc., 17; housewife, 17; airline hostess, 12; medical doctor, 12; scientist, 8; farmer or rancher, 8; and waitress, 7.

Georgia Field Test

A second field test was conducted in Brunswick, Glynn County, Georgia. Brunswick is located on Oglethorpe Bay four miles from the Atlantic Ocean. It is the county seat, has a population of 21,703, and has a retail trading zone estimated at 125,000. It is the Gateway City to the resort islands of St. Simons, Sea Island Beach, and Jekyll. The temperature range is reported as 42° to 96° F. The Brunswick area provided the setting for Sidney Lanier's famous poem, "Marshes of Glynn."

There were three classes totaling 90 pupils in the experimental group and three totaling 92 in the control group. The elementary supervisor and principals of the participating schools were all interested in the project and made all arrangements for testing, distributing materials, and obtaining reports from teachers.

The most popular vocational choices of the 83 Brunswick boys expressing preferences were for medical and military careers, with 15 naming each. Other popular choices were: scientist, 7; engineer, 6; pilot or astronaut, 5; teacher, 5; and professional athlete, 4.

Of the 97 girls who registered vocational preferences 34 chose teaching, almost identically the same percentage as chose teaching in the Richfield sample. Other popular choices among the girls were: nursing, 22; actress, 4; housewife, 4; medical doctor, 4; musician, 4; and secretary, 4.

South Dakota Field Test

A third field test was arranged in Sioux Falls, South Dakota, with the cooperation of Dr. Robert W. O'Hare, Administrative Assistant of the Sioux Falls School System. Sioux Falls is located in southeastern South Dakota in a rich agricultural area. Its temperature range is reported as minus 42° to 110° F. The 1960 census reports a population of 65,466 for the corporate city limits and 86,575 for the metropolitan area.

In this field test, the control and experimental groups were located in separate schools. There were four classes totaling 95 in the experimental school and two totaling 60 in the control school. An attempt was made to match the schools for general range of ability, socio-economic status of families, and the like. In addition, a class of 30 gifted children were also exposed to the experimental program. Dr. O'Hare administered all details of the project in Sioux Falls.

There was no exceptionally popular vocational choice among the 104 boys expressing preferences. The most frequent choices were: pilot or astronaut, 10; manual labor, 9; military service, 8; sales work, 7; professional athletics, 6; scientist, 6; artist, cartoonist, and designer, 5; medical doctor, 5; operator of bulldozer, tractor, truck, etc., 5; and farmer or rancher, 4.

Teaching was again the most popular choice among the girls, with 23 of the 83 girls making this choice. Other popular choices among the girls were: nursing, 11; medical doctor, 5; actress, 4; social work, 3; and saleswoman, 3.

Data Collection Procedures

At the beginning of the school term and before the experimental materials were introduced, the following assessment instruments were administered:

Test of Creative Thinking (Abbreviated Form VII)
Imaginative Story Writing (Forms A and B in alternate form design)
Sounds and Images Test of Originality (Forms I and II in alternate form design)
How I Like School.

Scores on the achievement tests (Iowa Tests of Basic Skills in Richfield and Sioux Falls and California in Brunswick) were obtained from the official school records.

Immediately after the Christmas vacation, subjects in all three settings were administered the "Things Done During Christmas Vacation" checklist.

After the use of the experimental materials and in May near the end of the school term the post-training tests were administered to subjects in both the experimental and control groups. The same forms of the "Test of Creative Thinking" and the "How I Like School" inventory were administered at the beginning and end of the experiment. Alternate forms of the "Imaginative Stories," "Sounds and Images," and achievement tests were used. Teachers were also asked to make nominations on four different criteria of creative behavior.

Reaction reports on each set of materials were obtained from teachers throughout the project. In September, soon after the end of the summer vacation, the "Things Done During Summer Vacation" checklist was administered.

Reaction Reports by Teachers

The reaction reports submitted by the 23 experimental teachers on each set of material indicated that the dramas and the lessons were generally received with considerable enthusiasm and that the basic idea of guided, planned experiences in creative thinking was carried out. Some of the teachers who initially expressed rather negative reactions concerning the materials gradually became more positive and it was apparent that they became more successful in using them. It was equally apparent that some of the teachers did not ever grasp the idea of guided, planned experiences in creative thinking. In a number of cases it was clear that the recorded dramas and lessons were played without giving the pupils any chance whatsoever to engage in any of the creative activities suggested. In a few cases the teacher even left the room while the recording was being played and was unable to report the reactions of pupils to either the drama or the lesson. Many of the teachers, however, prepared their pupils very carefully for both the dramas and the lessons and related them to the remainder of the curriculum.

Pupil Reaction to the Dramas

In almost all classes, the recorded dramatizations seemed to grip the imagination of pupils. In only three cases was a lack of interest reported. In 80 percent of the cases, unqualified enthusiasm was reported. On the basis of a five-point rating scale applied to each report, the following rankings from most to least enthusiastic reception were obtained:

1. The Dog They Named King
2. Master of Miracles
3. Wizard on Wheels
4. Wings for the World
5. Giovanni and the Giant
6. All-Around American
7. Minstrel's Christmas
8. Captains of Courage
9. Eyes at Their Fingertips
10. Polar Pilot
11. Trailblazer to the Stars

The relative unpopularity of "Trailblazer to the Stars" may have been due in part to the fact that it was the first tape used in the series and the teachers had not become effective in the use of this media of instruction. As will be seen later, a number of teachers felt that some of the concepts involved in this drama are too difficult for fourth-grade pupils. Some of them felt that it should have been scheduled later in the series. Seventeen of the 23 teachers, however, reported unqualified enthusiasm for this drama. One teacher, for example, reported: "My class for the first time this year became enthusiastic about something in school." The relative unpopularity of "Polar Pilot" is apparently due to an almost reverse situation. Many of the classes had studied the Antarctic early in the year and "Polar Pilot" was not made available until later in the term.

In almost all of the reports, teachers were able to identify specific pupils who had reacted with special enthusiasm and to describe behaviors which indicated high levels of involvement. This involvement appears to have been due to special interests through hobbies, vocational goals, parental occupations, or the special status of some family member (such as the blindness of a grandmother in the case of "Eyes at Their Fingertips").

In some cases boys in general were mentioned as being more excited about the drama than girls. In the case of "Minstrel's Christmas," some of the teachers reported that girls were more interested than boys. In 115 of the 150 cases (77 per cent) in which the sex of the pupil showing the greatest interest was identified a boy was named. When girls were cited, the report tended to come either from the gifted classes at Sioux Falls or be related to one of the fantasies. Some teachers also indicated that the "isolated" or "fringe" type child responded more deeply to the experimental materials than to anything else in the curriculum. Some teachers reported that they had better listening from the non-conformists of the class than from the more conforming children.

In summary, it might be inferred that the experimental materials had a special appeal to boys, gifted girls, and non-conforming, isolated (perhaps creative) children.

Pupil Reaction to Recorded Lessons

Teachers' reports of pupil reaction to the recorded lessons were coded according to a five point scale ranging from rejection to enthusiastic reception. In only eight cases did the teachers report that the recorded lesson was rejected by the class. The following ranking was obtained:

1. Master of Miracles
2. All-Around American
3. Dog Named King
4. Minstrel's Christmas
5. Wizard on Wheels
6. Captains of Courage
7. Giovanni and the Giant
8. Wings for the World
9. Polar Pilot
10. Eyes at Their Fingertips
11. Trailblazer to the Skies

A majority of the classes, however, responded enthusiastically to even the least popular lesson.

Suitability of Content and Difficulty Level

In general, the teachers using the experimental materials regarded them as being suitable both in content and level of difficulty. Quite interestingly, the recordings rated most frequently as being too difficult were the first two in the series, "Trailblazer to the Stars" and "Captains of Courage." This may well be due to the fact that the teachers had not yet learned how to prepare their classes for the recordings and to give the alert kind of guidance needed for the success of any material. In a few cases, the teachers felt that the experimental materials were not relevant to the fourth-grade curriculum. Yet other teachers in the same system saw numerous and in many cases multiple tie-ins with the curriculum. Thus, relevance of content and level of difficulty appear to be a function, at least to some extent, of the teacher's imagination and ability to see relationships.

Resulting Learning Experiences

In order of frequency of mention, the following kinds of learning experiences resulted from the recorded materials:

	Number of times mentioned
Problem-solving discussion, thinking, evaluation	87
Creative writing experience	53
Creative art experience	51
Inquiry through reading, bringing in new materials	44
Acquisition of new information	30
Independent projects	19
Oral reports to class to communicate discoveries, etc.	19
Inventions, experiments, etc.	18
Map making, map concepts, etc.	16
Music, songs, etc.	13
Vocabulary building	11
Increased awareness of world	10
Cooperative projects	8
Changed or improved attitudes	8
Creative dramatics	6
Debate	5

These data provide clues for modified emphases in the teachers' guides. For example, more helpful ideas need to be given for creative dramatics, debates, and perhaps for cooperative projects. The experimental materials, however, seem to have been successful in stimulating a variety of learning experiences.

A checklist instead of a free response would perhaps result in a more complete picture of the learning experiences which resulted from the use of the experimental materials. The present reporting form, however, resulted in data which picture the nature of the planned, guided experience in creative thinking.

From the data provided it seems clear that both the "Great Moments of Discovery" recordings and the fantasies lend themselves to the planned, guided experience concept. The following description by one teacher of the learning experiences which resulted from "Minstrel's Christmas" is illustrative:

> "The pupils wrote poetry and compiled their creative writings into booklets. One group studied the stories behind several Christmas carols, made dioramas to illustrate the carols, and presented a program for a retarded class. They gave the dioramas to the pupils in the retarded class. This proved to be a rich experience for both givers and receivers--and especially the teacher. A follow-up discussion of the meaning of Christmas was soul-searching. The pupils expressed their feelings and ideas freely . . ."

Suggestions for Improved Effectiveness of Experimental Materials

Suggestions for improving the effectiveness of the experimental materials were offered in only 28 percent of the reports. A wide variety of suggestions were included, however. The following are the most frequently mentioned suggestions:

	Number
Substitution of a different lesson for present lesson	10
Coordinate scheduling of materials with curriculum	8
Eliminate dialects (objectionable or difficult to understand)	8
Give more difficult and challenging problems	3
Shorten; too time-consuming	3

Other suggestions included the following: eliminate fantasies (children this age are more interested in real people); music is too loud; eliminate stop-tape device or use fewer stops; make follow-up lessons more directly related to dramas; do not repeat the statements (in lesson); make drama less factual and technical; simplify story or otherwise make easier; use a familiar fairy tale instead of an original fantasy; find a more unusual fantasy instead of a familiar one; make tapes about creative women; use younger voices for children (Dog Named King); find something to substitue for "Gee" and "By golly;" and give fewer suggestions in the teachers guides.

Suggestions for the substitution of another lesson for the one provided occurred most frequently in regard to the alternate lesson for "Captains of Courage." The Principal Investigator had sensed in advance that some teachers might object to this lesson and it was for this reason that it was offered only as an alternative lesson. Although some teachers elected to use this alternative lesson and found it to be successful, it should probably be omitted in the revised version. Single objections were offered to the lessons for "Trailblazer to the Skies," "All-Around American," and "Wizard on Wheels." In general, however, these three lessons seemed to be among the most successful lessons in the series.

The matter of coordination can readily be solved by individual teachers now that a library has been developed. Unfortunately, not all of the tapes were available at the time the field tests got underway. Thus, "Polar Pilot" was offered near the end of the series and might best have been offered at the time the Antarctic was a subject of study. "Captains of Courage" might have been postponed until classes had completed some of their study of map making. "Trailblazer to the Skies" might also have come later in the term. Some teachers expressed the opinion that many of the tapes would be more appropriate in the fifth grade curriculum than in the fourth grade.

The use of modified accents or dialects was maintained as a part of our attempt to make the dramas as authentic as possible. Objections were raised concerning the accents or dialects in "Trailblazer to the Stars," "Captains of Courage," "Minstrel's Christmas," and "Wings for the World." The most serious offender seems to have been the French accents used by the actors in "Eyes at Their Fingertips." In revisions of this tape the accents might be eliminated or reduced.

The complaints about the length of the tapes seem to have resulted from misunderstandings about the use of the dramas and lessons. Some teachers attempted to use the dramas and lesson or lessons in a single session and saw the materials apart from the curriculum rather than as aids to be integrated into the curriculum. The following quotation from a report regarding "The Dog They Named King" illustrates this misunderstanding:

> "The children loved it and wanted more, but if only we could have it in shorter time consumption. Each part seems sufficient for one period. Doing the three parts in one project is too time consuming with the full schedule of teaching otherwise."

It is interesting to note that only one teacher voiced disapproval of the realistic treatment of personalities of the scientists and inventors who were the subjects of dramas. Several advisers had suggested that the personalities of the subjects of the dramas be presented as more "normal" or better "adjusted" socially. We had deliberately chosen, however, to present our characters as honestly and as sympathetically as possible. The single complaint read as follows:

> "The children seemed to get the impression from the tape that scientists are mentally unbalanced. Their drawings and stories leaned a bit in that direction too. Perhaps less should be said about people thinking scientists are queer."

This impression might perhaps have been avoided by more sympathetic handling by the teacher and the development of greater tolerance and appreciation of individuality.

Chapter 5

GROWTH IN CREATIVE THINKING ABILITIES

It will be recalled that one of the primary purposes of the project described in this report was to assess the effectiveness of the use of the experimental materials in obviating or minimizing the slump in the development of the creative thinking abilities found almost invariably in the fourth grade in schools in the United States. The previous studies, however, did not involve repetitions of the same measures at two or more different points during the fourth grade. One could infer from these studies, nevertheless, that little or no growth in the creative thinking abilities takes place during this period when their development is left to chance. In cross-sectional studies drops in the developmental curve have been observed both when the administration of the measures took place near the beginning and near the end of the school term. These cross-sectional studies, however, have usually shown growth between the fourth and fifth grades. In some cases, however, the growth has been in fluency and not in originality (Torrance, 1962b).

It was expected that the use of the audio-tapes and their accompanying guided and planned experiences in creative thinking would contribute to the growth of such creative or divergent thinking abilities as fluency, flexibility, originality, and elaboration. Since no effort was made to restrain the control teachers from carrying out their own experiments to develop these abilities, it was expected that the controls too might show growth in these abilities. Furthermore, it was expected that the well-known "Hawthorne" or "experimental" effect would be in operation to produce growth where growth does not ordinarily occur. Thus, to expect children in the experimental conditions to show greater creative growth than their peers in the control conditions subjects the experimental materials to a rather severe test.

Since it was expected that the use of the experimental tapes would contribute to the growth of the creative thinking abilities, it is desirable to test the relevant hypotheses by means of a one-tail test. However, to keep low the type two error which is the "probability of accepting a hypothesis when some alternative is true" (Walker and Lev, 1953, p. 61) and also to conform to general practices, the following two null hypotheses were tested, using two-tail tests.

1. The first hypothesis to be tested arises from the assertion made above concerning the development of the creative thinking abilities of fourth-grade pupils. It has been noted earlier that the beginning of the fourth grade ushers the child into the "stage of realism" and the "gang stage" in which there is constant pressure to conformity. As a result of these and many other forces under ordinary conditions in our society the growth of the creative thinking abilities is arrested, even retarded. It is crucial, therefore, to determine whether this statement held true in the case of the fourth-grade pupils included in this study, both as controls and as experimentals. Thus, the appropriate null hypothesis is that the control and experimental groups, considered separately, performed equally well on the pre- and post-tests of creative thinking abilities.

The measures used have already been described in the third chapter and sample copies of the instrument are included in the appendix.

2. A related hypothesis is that there is no difference between the relative growth in the creative thinking abilities of the fourth grade pupils who formed the experimental groups and those who formed the control groups. In other words, if the creative thinking abilities of the pupils in the two groups are measured at the time of their entry into the fourth grade and again at the end of the school term, the growth observed for the two groups is equal after the influence of the pre-test scores have been taken into account.

Results

Differences in Pre- and Post-Test Performance

The means and standard deviations of the twelve different measures of creative thinking are shown in Tables 1, 2, and 3 for both the experimental and control groups on both the pre- and post-tests. It should be noted that in all cases data could be used for only those pupils who were present at the time of both the pre- and post-testing.

Table 1

Means and Standard Deviations of the Pre- and Post-Test Creative Thinking Ability Scores of the Experimental and Control Groups in the Richfield, Minnesota, Study

	Experimentals (N=331)				Controls (N=316)			
	Pre-		Post-		Pre-		Post-	
Variable	Means	S. D.	Means	S. D.	Means	S. D.	Means	S. D.
Non-Verbal Fluency	20.86	6.69	24.80	6.68	22.00	7.02	23.39	6.20
Non-Verbal Flexibility	15.81	4.97	17.92	5.01	16.43	5.06	17.34	6.04
Non-Verbal Originality	13.68	7.25	15.06	6.99	16.62	11.80	14.46	6.04
Non-Verbal Elaboration	64.23	29.88	69.09	40.37	61.74	26.19	61.42	37.56
Verbal Fluency	21.47	11.03	33.20	15.36	24.78	13.58	35.50	16.68
Verbal Flexibility	10.11	4.29	13.33	4.87	10.19	4.21	13.37	4.74
Verbal Originality	14.30	9.98	24.89	15.92	17.31	12.99	24.85	15.67
Verbal Elaboration	2.16	3.31	2.71	3.69	2.33	2.90	1.98	3.32
Imaginative Stories Total	4.70	2.57	4.83	2.39	5.42	2.67	5.11	2.91
Sounds and Images	21.17	10.85	21.18	8.75	20.53	10.39	21.49	7.43

Table 2

Means and Standard Deviations of the Pre- and Post-Test Creative Thinking Ability Scores of the Experimental and Control Groups in the Brunswick, Georgia, Study

	Experimentals(N=74)				Controls(N=61)			
	Pre-		Post-		Pre-		Post-	
Variable	Means	S. D.	Means	S. D.	Means	S. D.	Means	S. D.
Non-Verbal Fluency	16.12	6.60	27.18	8.28	14.64	5.78	25.97	8.77
Non-Verbal Flexibility	13.42	4.95	18.22	5.04	11.90	4.43	15.57	4.57
Non-Verbal Originality	10.77	6.19	17.58	7.25	9.25	5.47	17.62	8.51
Non-Verbal Elaboration	17.41	9.05	71.15	26.78	10.57	7.46	75.41	31.22
Verbal Fluency	23.18	12.86	39.34	21.14	15.34	9.62	30.26	18.67
Verbal Flexibility	10.45	5.51	14.65	6.45	8.57	4.66	12.02	6.11
Verbal Originality	18.96	14.09	29.03	21.08	12.05	9.53	20.67	15.52
Verbal Elaboration	2.14	4.16	6.96	11.96	1.82	3.82	3.97	3.94
Imaginative Stories Total	2.78	2.19	4.01	3.17	2.28	2.04	2.71	2.22
Sounds and Images	15.14	8.75	22.18	7.80	10.95	7.65	20.53	13.59

Table 3

Means and Standard Deviations of the Pre- and Post-Test Creative Thinking Ability Scores of the Experimental and Control Groups in the Sioux Falls, South Dakota, Study

	Experimentals(N=67)				Controls(N=49)			
	Pre-		Post-		Pre-		Post-	
Variable	Means	S. D.	Means	S. D.	Means	S. D.	Means	S. D.
Non-Verbal Fluency	19.03	5.45	21.24	5.96	23.06	6.88	23.10	6.00
Non-Verbal Flexibility	13.81	4.36	16.96	4.94	17.02	4.88	16.10	4.27
Non-Verbal Originality	13.53	6.30	14.46	7.49	15.53	7.28	15.61	5.79
Non-Verbal Elaboration	38.47	23.43	57.52	23.62	27.67	14.42	55.88	21.68
Verbal Fluency	18.43	8.82	30.59	17.21	22.31	13.15	31.78	14.58
Verbal Flexibility	8.88	3.99	14.60	9.16	8.00	3.27	12.12	5.09

Table 3 continued

	Experimentals(N=67)				Controls(N=49)			
	Pre-		Post-		Pre-		Post-	
Variable	Means	S. D.	Means	S. D.	Means	S. D.	Means	S. D.
Verbal Originality	13.83	9.67	27.38	20.22	12.76	9.59	21.31	13.70
Verbal Elaboration	1.27	2.06	2.23	3.82	1.96	4.01	1.18	1.65
Imaginative Stories Total	5.49	3.10	7.00	4.16	5.33	2.40	6.76	3.42
Sounds and Images	15.35	6.92	31.34	8.55	14.84	7.45	31.63	10.11

It will be observed from Table 1 that the Richfield Experimental Group showed gains on all ten of the creative thinking measures. The Richfield Control Group, on the other hand, showed losses on four of these measures. In Table 2 it will be observed that both the experimentals and controls in the Brunswick experiment showed gains on all measures. In Table 3 it will be observed that the experimentals in the Sioux Falls study showed gains on all of the measures but that there were reversals in two of the measures for the control group.

It was necessary to use correlated or dependent t-tests to test the first hypothesis since, in this situation, the post-test scores were correlated with the pre-test scores, being scores for the same sets of individuals on the same measures on two different occasions. The results obtained are presented in Table 4.

Table 4

Summary of t-ratios of Differences in Means of Pre- and Post-Test Scores of Creative Thinking Ability Measures for Experimentals and Controls in Richfield, Brunswick, and Sioux Falls, Studies

		t-ratios		
Variable	Treatment	Richfield	Brunswick	Sioux Falls
Non-Verbal Fluency	Experimental	10.16**	10.73**	2.57*
	Control	3.25**	11.41**	0.04
Non-Verbal Flexibility	Experimental	7.36**	8.01**	4.70**
	Control	2.76**	5.86**	-1.33
Non-Verbal Originality	Experimental	2.83**	7.54**	1.09
	Control	-3.06**	7.79**	0.08
Non-Verbal Elaboration	Experimental	1.99*	18.50**	5.46**
	Control	-0.14	16.15**	11.58**
Verbal Fluency	Experimental	14.69**	7.49**	7.54**
	Control	11.13**	6.72**	5.05**

Table 4 continued

Variable	Treatment	t-ratios Richfield	 Brunswick	 Sioux Falls
Verbal Flexibility	Experimental	11.38**	6.90**	6.24**
	Control	10.47**	4.77**	6.46**
Verbal Originality	Experimental	12.66**	4.41**	6.56**
	Control	7.90**	4.93**	5.25**
Verbal Elaboration	Experimental	2.16*	3.24**	1.37
	Control	-1.79	3.39**	-1.19
Imaginative Stories Total	Experimental	0.81	2.68**	3.23**
	Control	-1.68	1.41	3.45**
Sounds and Images	Experimental	0.00	6.58**	16.62**
	Control	1.44	5.67**	11.46**

Note: *Significant at .05 level of confidence
**Significant at .01 level of confidence

It will be observed from Table 4 that in the Richfield study the controls showed a tendency toward reversal (negative t values) on four of the ten variables, and on one of these four, significantly so at the .01 level. In contrast, the Richfield experimentals showed similar behavior on none of the variables.

In the Sioux Falls study, the controls showed reversals on two variables. The differences were not statistically significant, however. This group also showed lags on two additional variables. In contrast, the experimental group showed no reversal on any of the creative thinking variables and showed significant gains on eight of the ten variables.

The outcomes for the Brunswick groups are not so clear-cut. Both the experimental and control groups showed significant improvement on all of the measures except the Imaginative Stories Test in the case of the control group.

These findings to a limited degree corroborate earlier findings and indicate that the use of the experimental materials apparently contributed to a reversal of the fourth-grade slump in creative development. One may wonder why the results failed to fall entirely in line with earlier studies. Several very plausible explanations can be offered. In this study, it was fully expected that the wellknown "Hawthorne Effect" would be operating and it is perhaps noteworthy that this effect did not result in gains in all of the control groups. It is known that some of the teachers in the control groups conducted experiments of their own in deliberate attempts to contribute to growth in the creative thinking abilities. In the Richfield and Brunswick studies, experimental and control groups were housed in the same buildings. In all three locations, the pre-tests and the "Things Done During Christmas Vacation" were of such a nature that they might be expected to contribute to the "Hawthorne Effect."

Another obvious explanation could be the recent trend in education towards emphasizing creative behavior. This might have been heightened in the present study by the limelight which has been focused on the fourth grade and by the continuing work of the resource or helping teachers, especially in the Richfield study. During the past three or four years, parents and teachers throughout the United States have shown an increasing awareness of and interest in the encouragement of creative development.

Growth Shown by Special Gifted Classes at Sioux Falls

The results of the pre- and post-tests on the measures of creative thinking ability of the 30 pupils in a special program for gifted children are presented in Table 5. It will be noted that these subjects were initially rather high on all of the measures and that they showed gains on all of the measures except verbal elaboration and non-verbal originality. The gains were statistically significant on non-verbal fluency, verbal fluency,

Table 5

Means and Standard Deviations of the Pre- and Post-Test Creative Thinking Ability Scores of the Special Gifted Classes at Sioux Falls, South Dakota

	Pre-		Post-		
Variable	Means	S. D.	Means	S. D.	t-ratio
Non-Verbal Fluency	23.93	7.68	28.00	9.27	1.8382*
Non-Verbal Flexibility	18.50	4.70	20.27	7.27	1.2312
Non-Verbal Originality	21.23	7.95	20.07	7.67	-0.5557
Non-Verbal Elaboration	64.23	30.36	65.70	30.17	0.2507
Verbal Fluency	38.40	16.25	55.67	21.96	3.8448**
Verbal Flexibility	13.43	3.39	18.93	7.12	4.6116**
Verbal Originality	23.13	11.25	45.37	21.90	5.9374**
Verbal Elaboration	5.33	5.29	3.27	4.30	-1.9375*
Imaginative Stories Total	8.47	2.01	9.20	3.78	0.9362
Sounds and Images	21.27	6.77	32.43	13.16	4.6229*

Note: *Significant at .10 level of confidence
**Significant at .05 level of confidence
***Significant at .01 level of confidence

verbal flexibility, verbal originality, and Sounds and Images. The reports by the teacher of the subjects in this special program described many outstanding projects and achievements resulting from the use of the audio-tapes and related materials.

Differences in Growth of Experimentals and Controls

The second hypothesis requires a test of the differences in growth between the experimentals and controls and may be stated as follows: there was no difference between the growth of the creative thinking abilities of the experimental and control groups. The term "growth" for this purpose was defined as the mean of the post-test scores adjusted for pre-test scores of the individuals under the two conditions.

The means and standard deviations of all of the creative thinking measures, both pre- and post-tests, have already been presented in Tables 1, 2, and 3. These tables do not help greatly in reaching a conclusion about the superiority of the experimentals over the controls because the means of the pre-test scores were not exactly the same for the groups under the two conditions. It was necessary, therefore, to control for the effects of initial differences statistically. This was accomplished by using analysis of covariance. The means of the post-test scores adjusted for pre-test scores are given in Table 6 which also includes the F-ratios.

Table 6

Post-Test Means Adjusted for Pre-Test Means on Creativity Measures, and F-ratios for the Three Samples

	Richfield			Brunswick			Sioux Falls		
Variable	Exp.	Cont.	F-ratio	Exp.	Cont.	F-ratio	Exp.	Cont.	F-ratio
Non-Verbal Fluency	25.11	23.22	12.86**	26.82	26.21	0.22	23.04	22.35	0.36
Non-Verbal Flexibility	18.00	17.18	4.46*	17.97	15.79	8.74**	17.96	15.53	9.26**
Non-Verbal Originality	14.95	14.40	0.89	17.31	17.97	0.28	14.98	15.10	0.01
Non-Verbal Elaboration	68.30	56.29	13.05**	68.27	78.45	3.97*	57.36	58.08	0.03
Verbal Fluency	33.80	32.63	0.82	36.82	32.39	1.96	31.46	29.96	0.39
Verbal Flexibility	13.14	13.08	0.03	14.17	12.42	3.95*	14.06	12.79	1.31
Verbal Originality	25.28	22.69	4.23*	27.63	22.39	3.10	27.23	21.93	3.88
Verbal Elaboration	2.69	2.27	1.87	6.78	3.96	3.49	2.76	1.18	4.70*
Imaginative Stories Total	4.82	4.77	0.05	3.97	2.71	7.30**	6.98	6.69	0.21
Sounds and Images	20.66	22.03	3.63	21.34	20.78	0.10	29.76	31.59	1.42

Note: *Significant at .05 level of confidence
**Significant at .01 level of confidence

Table 6 shows that of the thirty pairs of mean scores, twenty-five showed superiority for the experimental group over the control group and only five behaved the other way round. This finding itself is impressive, specially because adjustment has already been made for whatever initial differences may have been present. However, it deals only with the direction of the differences and not with their magnitudes. The F-ratios must be examined for this purpose. Five of the thirty F's are significant at the .05 level and five at the .01 level. Considering the fact that we are operating at the .05 level of significance, we would expect not more than two (1.5 to be exact) significant differences by chance alone. The results do have meaning and importance, therefore, in the whole scheme of things and show that the experimental procedures have been fruitful.

Of the ten significant differences, only one favors the control group. This singular reversal is rather unexpected but it may have been a chance occurrence. All the others favor the experimental group.

On three of the ten variables significant differences were not found for any of the three samples. They are Non-Verbal Originality, Verbal Fluency, and Sounds and Images. Of the five pairs of adjusted means on which the control group was found to be superior, four are accounted for by these four variables.

The seven variables on which significant differences for one or more samples were discovered are discussed below.

Non-Verbal Fluency

The Non-Verbal Fluency score was the arithmetic sum of the fluency scores on the Incomplete Figures Test and the Circles Test. On the former, it is defined as "the number of figures completed" and on the latter as "the number of relevant responses minus the number of duplications and irrelevant responses."

In each of the three samples, the experimental group showed superiority over the control group on this variable. But only in the Richfield area did the difference reach the magnitude required for statistical significance. In this particular case, it was significant at the .01 level. The conclusion, then is unambiguous. The students using the "planned experiences in creative thinking" performed significantly better than or as well as the students in the control group. On the basis of this finding, therefore, the use of the tapes can be justified, at least not discouraged.

Non-Verbal Flexibility

The Non-Verbal Flexibility score was the arithmetic sum of its components on the two non-verbal tests, viz. Incomplete Figures Test and the Circles Test. On both of them, the variable is defined in terms of the number of categories into which responses fell. The categories were determined empirically as described earlier.

This is the only variable on which the experimental group showed significantly more growth than the control group in each sample. In fact, two of the three samples showed this superiority at the .01 level of significance. There is, therefore, unmistakable evidence to support the statement that the use of "programmed experiences in creative thinking" contributes the superiority of the experimental group over the control group on Non-Verbal Flexibility scores, justifying their use on this basis **alone**.

Non-Verbal Elaboration

The Non-Verbal Elaboration score was also obtained by adding together the elaboration scores on the two non-verbal tests. As stated earlier, the elaboration score indicated the number of pertinent ideas added to the original stimulus figure, to its boundaries, and/or to the surrounding space.

On this variable, in the Richfield sample, the experimentals showed superiority over the controls at the .01 level of significance. In the Brunswick sample, the situation reversed and the control group showed superiority at the .05 level of significance. It will be recalled, however, that both of the Brunswick groups were especially low on the Non-Verbal Elaboration on the pre-test. In the Sioux Falls sample too, the control group showed an advantage but it was not significant. On this basis then, nothing can be said for or against the use of "programmed experiences in creative thinking" in the fourth grade. It is gratifying to note that such conflicting findings were not repeated in the case of any other variable.

Verbal Flexibility, Originality, and Elaboration

The Verbal Flexibility, Originality, and Elaboration scores were the sums of the corresponding sub-scores on the two verbal tests, viz. Product Improvement and Unusual Uses of Tin Cans.

Considering the nine pairs of adjusted mean scores we find from Table 6 that without exception, the experimental group scored higher than the control group. However, when we consider the statistical significance of these differences, we find that only one of the three experimental groups showed superiority over the corresponding control groups on each variable. Moreover, it is interesting to note that the significantly superior experimental sample is different in the case of different variables: Brunswick on flexibility, Richfield on originality, and Sioux Falls on elaboration. The conclusion is clear-cut. The experimental groups consistently did as well as, or better than, the control groups, indicating the advisability of using "programmed experiences in creative thinking" for the purpose for which they were developed.

A Brief Comparison of the Results on Non-Verbal and Verbal Variables

At this point of the report, the results on the four non-verbal and the four verbal variables for the three samples can be briefly compared and contrasted. Here we are dealing with twenty-four pairs of adjusted means, i.e. the means adjusted for the initial performance of the subjects in the sample.

(1) Of the twelve pairs on the non-verbal variables, six show statistically significant differences, two at the .05 level and four at the .01 level. But, of the twelve pairs on the verbal variables, only three reached the magnitude required for statistical significance.

(2) On four non-verbal pairs, the adjusted means were in favor of the controls and on one of them, significantly so. No such reversal was found on any of the verbal pairs of adjusted means.

(3) On non-verbal originality, no significant difference was found for any of the three samples. The verbal variable with a similar property was fluency.

(4) Among the non-verbal variables, flexibility is the one on which all three samples showed significant superiority of the experimentals over the controls. No verbal variable with this property was found.

Imaginative Stories Total

The total score on Imaginative Stories was the sum of the subscores on Interest and Originality as defined specifically for this test. Interest was judged on the basis of the following nine characteristics: (1) conversational tone, (2) naturalness, (3) use of quotations, (4) variety in kind of sentences, (5) variety in length of sentences and in the structure of sentences, (6) personal touch, (7) humor, (8) questions and answers, and (9) feelings of characters. Originality was assessed on the basis of the following nine points: (1) picture-sequeness, (2) vividness, (3) flavor, (4) personal elements, (5) original solution or surprising ending, (6) original setting or plot, (7) humor, (8) invented names, words, etc., (9) other unusual twist in style or content.

In all three samples, the experimentals performed better than the controls. The difference was statistically significant, however, only in the Brunswick sample.

Conclusion

In spite of the fact that many of the teachers of the control groups used a variety of deliberate methods to encourage creative growth and in spite of the fact that some of the teachers of the experimental groups clearly did not use properly the audio-tapes and auxiliary materials, in some cases doing nothing more than playing the tapes, the evidence in favor of the experimental procedures is reasonably strong. In one or more of the settings, the experimental groups excelled the control groups in non-verbal fluency, flexibility, and elaboration; verbal flexibility, originality, and elaboration; and total scores on the Imaginative Stories Test. Even on some of the other measures, encouraging evidence can be cited. For example, the experimental subjects in the Richfield study made statistically significant gains on non-verbal originality and the controls showed statistically significant losses in non-verbal originality.

Chapter 6

LIKING AND DISLIKING SCHOOL

The Principal Investigator has argued that a failure to provide children opportunities for using what they learn as tools in their thinking robs children of one of the greatest rewards of learning. Thus, it was expected that one of the possible outcomes of using the guided, planned experiences in creative thinking developed through this project would be reflected in increased ability to maintain the natural excitement of children about learning and school. He has maintained further that this problem becomes especially important at about the fourth grade and it is at this time that the seeds for future school dropouts begin to germinate.

No really suitable instrument was available for assessing the degree to which children are excited about learning and there were insufficient time and resources to permit the development of such an instrument. Thus, we chose to use Hoyt's "How I Like School" inventory which has already been described. This instrument contains a variety of items concerning the pupil's liking or disliking for school, relationship with his teacher, interest in learning, and the like. A score was obtained by totaling all positive responses (i.e. responses indicating a favorable attitude concerning school, learning, and the teacher).

Stated in null form, the major hypothesis is: the fourth-grade pupils in the experimental and control groups showed equal changes in their attitudes concerning school during their work in the fourth grade and that the experimental materials, therefore, had little influence in this respect.

Results

Analysis of Changes in Attitudes

It will be recalled that in order to protect the subjects and to assure more honest responses no self-identifying information was placed on the completed "How I Like School" inventories. Blanks were deposited by subjects directly in a large envelope. Experience proved that this precaution was highly justified. Some of the teachers were extremely anxious to find out how specific pupils responded. At least one teacher ascertained how a particular pupil responded and confronted his parents with the information. Fortunately the parents were quite wise, assuring the teacher that boys this age frequently say that they do not like school because "it is the thing to say" and not because they do not actually like school. This anonymity limited us, however, in making statistical analyses of the data. Although we have data in the pre- and post-training situations, we cannot make comparisons for the same individual. Thus, the application of analysis of covariance, using subjects within cells as replications is not possible. We can certainly use the pre- and post-training means of the classes instead, even though this necessarily means a considerable loss of information. (This is a typical case of compromise in research to protect subjects. Had we chosen to use identifying information, we could have avoided this loss of information but we would have had to place fourth grade children in a position which would have made it difficult for them to be honest without retribution from teachers and/or parents.)

The results of the analysis of covariance are presented in Table 7.

Table 7

Analysis of Covariance of Results Obtained from "How I Like School" Inventory for Richfield, Brunswick and Sioux Falls Groups

Sample	Number Classes	Pre-Test Means	Post-Test Means	Adj. Post-Test Means	F-ratio	Level of Significance
Richfield						
Experimental	15	39.77	37.87	37.52	0.96	Not Significant
Control	15	38.45	36.09	36.44		
Brunswick						
Experimental	3	39.93	39.67	40.13	5.13	Not Significant
Control	3	37.08	37.02	36.56		
Sioux Falls						
Experimental	3	37.72	41.42	40.24	0.69	Not Significant
Control	3	40.90	41.48	43.25		

It will be noted that in all three situations the adjusted mean scores of the experimental and control subjects failed to show statistically significant differences. In fact, the total mean scores would lead us to infer that the attitudes of fourth-grade pupils concerning their school, teachers, and learning are rather stable and do not change from September to May. In the Richfield and Brunswick situations, however, there is a slight tendency for the adjusted post-training mean scores of the experimental classes to exceed those of the control groups. The reverse is true in the Sioux Falls situation. It will be recalled, however, that in Richfield and Brunswick the experimentals and controls were housed in the same buildings and that in Sioux Falls the experimentals and controls were in separate buildings. Actually, however, the Sioux Falls experimentals showed a gain of about four points while the controls showed a slight loss. Thus, the lower adjusted post-training means of the Sioux Falls experimentals is certainly not significant psychologically.

In interpreting these results, it should be remembered that no deliberate and concerted effort was made to influence attitudes concerning school. It was believed, however, that the subtle influence of the experimental materials and their creative use would contribute to this goal. Since the inventory consists of such a variety of items, it was thought that meaningful gains in some areas might be cancelled out by losses in others less important in the light of the interests in this project. Thus, eight items of special interest to the objectives of this project were selected for detailed analysis.

Analysis of Responses to Critical Items

The eight items selected for special study are those most specifically concerned with the enjoyment of school, the feeling that one is important, freedom to inquire, and hating school.

The results for the Richfield sample are presented in Table 8.

Table 8

Comparison of Pre- and Post-Test Responses Under Experimental and Control Conditions of Pupils in Richfield Sample on Selected Items of the "How I Like School" Inventory

	Experimentals				Controls			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
Item	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Is your school room a happy place?	345	86.3	322	80.9	332	83.0	299	78.9
Do you feel important in school?	198	49.5	165	41.4	206	51.5	143	37.7
Do most children in your room like to stay away from school?	157	39.3	182	45.7	161	40.3	178	46.9
Do you like to stay out of school?	105	26.3	123	30.9	120	30.0	123	32.4
Do you enjoy school?	317	79.3	288	72.4	293	73.3	257	67.8
Are you invited to ask questions?	346	86.5	343	86.2	340	85.0	325	85.7
Are you afraid to ask questions?	51	12.8	70	17.6	59	14.8	67	17.7
Do you hate school?	68	17.0	84	21.1	85	21.3	108	38.5
Total Responding	400		398		400		379	

The difference in percentages or proportions at the time of the post-test is statistically significant for the very critical item, "Do you hate school?" This difference is significant at better than the .01 level of confidence. It should be observed further that a significantly larger percentage of the controls state that they hate school at the end of the term than at the beginning of the term. This is not true of the experimentals. The importance of this finding is further supported by the additional observation that a larger number of subjects in the control groups were absent at the time of the post-test (21 less than were present for the pre-test) than of subjects in the control groups (only two less than for the pre-test).

The results for the Brunswick sample are included in Table 9.

Table 9

Comparison of Pre- and Post-Test Responses Under Experimental and Control Conditions of Pupils in Brunswick Sample on Selected Items of the "How I Like School" Inventory

	Experimentals				Controls			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
Item	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Is your school room a happy place?	71	81.6	81	89.9	72	78.2	75	82.4
Do you feel important in school?	56	64.4	63	69.9	48	52.2	55	60.4
Do most children . . like to stay away from school?	46	52.9	28	31.1	48	52.2	41	45.1
Do you like to stay out of school?	12	13.8	13	14.4	20	21.7	17	18.7
Do you enjoy school?	70	80.5	86	95.5	66	71.7	74	81.3
Are you invited to ask questions?	67	77.0	83	92.1	66	71.7	75	82.5
Are you afraid to ask questions?	60	69.0	22	24.4	24	26.1	17	18.7
Do you hate school?	13	14.9	5	5.6	19	20.6	11	12.1
Total Responding	87		90		92		91	

Contrary to the results in the Richfield sample, fewer of both the controls and experimentals say that they hate school at the end of the term than at the beginning of the term. There is a slight tendency in favor of the experimentals. This tendency is strengthened slightly by the fact that three more of the experimentals were present for the post-test than for the pre-test and one less of the controls were present for the post-test than for the pre-test. Three of the other differences in percentages at the time of the post-test are significant at about the .05 level of confidence or better. A greater proportion of the controls than the experimentals say that most children like to stay away from school. A greater proportion of the experimentals than the controls say that they enjoy school and that they are invited to ask questions. There is also a fairly strong trend for the experimentals to express greater feelings of self-worth than the controls.

The results for the Sioux Falls sample are presented in Table 10.

Table 10

Comparison of Pre- and Post-Test Responses Under Experimental and Control Conditions in Sioux Falls on Selected Items of the "How I Like School" Inventory

	Experimentals				Controls			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
Item	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Is your school room a happy place?	67	88.1	84	88.4	54	90.0	47	85.4
Do you feel important in school?	34	44.7	57	60.0	36	60.0	17	32.7
Do most children . . like to stay away from school?	27	35.5	27	28.4	18	30.0	15	27.2
Do you like to stay out of school?	22	28.9	14	14.7	8	13.3	6	10.9
Do you enjoy school?	61	80.2	85	89.5	50	83.3	47	85.4
Are you invited to ask questions?	58	76.3	88	92.6	44	73.3	47	85.4
Are you afraid to ask questions?	13	17.1	15	15.8	7	11.6	8	14.5
Do you hate school?	21	27.6	11	11.6	8	13.3	10	18.1
Total Responding	76		95		60		52	

The most significant result here is the greater feeling of self-worth expressed by the experimentals. At the beginning of the study, about 45 percent of the experimentals and 60 percent of the controls expressed the feeling that they felt important at school. At the end of the term, the situation was reversed: 60 percent of the experimentals and 33 percent of the controls expressed such feelings. The results related to the question on hating school are also noteworthy. At the beginning of the term about 28 percent of the experimentals said that they hated school but only about 12 percent expressed this feeling at the end of the year. The situation was somewhat different in the control groups: 13 percent assented to such a statement at the beginning of the term and 18 percent did so at the end of the term. It should also be noted there were 19 more children present for the post-test than for the pre-test in the experimental groups, whereas there were eight fewer present for the post-test than for the pre-test in the control classes.

The results for the special classes in the Sioux Falls study are shown in Table 11. It will be noted that there is little change expressed in the attitudes of these gifted children. At the beginning of the study, they liked school, felt important, and felt free to ask questions. At the end of the study this same positive attitude continued to persist.

Table 11

Comparison of Pre- and Post-Test Responses of Pupils in Special Class in Sioux Falls on the "How I Like School" Inventory

	Pre-Test		Post-Test	
Item	Number	Percent	Number	Percent
Is your school room a happy place?	29	96.6	28	93.3
Do you feel important in school?	19	63.3	21	70.0
Do most children . . like to stay away from school?	6	20.0	8	26.6
Do you like to stay out of school?	1	3.3	3	10.0
Do you enjoy school?	28	93.3	28	93.3
Are you invited to ask questions?	29	96.6	28	93.3
Are you afraid to ask questions?	1	3.3	3	10.0
Do you hate school?	0	0.0	1	3.3
Total Responding	30			

Observation on Absenteeism

In a number of studies in industry, absenteeism has been used as one criterion of the effectiveness of various personnel policies, work conditions, administrative changes, and the like. It is interesting to note in the present study that there were 20 more of the experimentals present for the post-test than were present at the time the pre-test was administered. This is in contrast to the fact that there were 27 fewer of the controls than the experimentals present for the post-test than were present for the pre-test. This observation is of special interest as a possible indicator that the experimental materials contributed to the maintenance, if not the improvement, of interest in attending school at the critical fourth-grade period.

Summary

Although the differences in liking-disliking school as measured by the "How I Like School" inventory are not statistically significant, the trend favored the experimentals. The analysis of responses to specific critical items supports more strongly the idea that the experimental materials contributed to a sustained or increased interest in school. In the Richfield sample, a significantly larger percentage of the controls than the experimentals said that they hated school. This trend persisted in the Brunswick and Sioux Falls samples. Few children in these two localities, however, expressed this strong a dislike for school. In the Sioux Falls study, the proportion of children hating school in the experimental groups decreased significantly while the proportion actually increased in the control groups (though not significantly). Of possible implication in the light of interest in school dropouts is the fact that 20 more of the experimentals were present for the post-test than for the pre-test while 27 fewer of the controls were present for the post-test than for the pre-test.

Chapter 7

PARTICIPATION IN INDEPENDENT CREATIVE ACTIVITIES

The explosion of knowledge, stepped up rates of change, and many other forces have caused many educators to plead for greater attention to self-initiated learning. A number of leaders have said that one of the missions of education should be to somehow equip children with the motivations and skills to continue learning the rest of their lives. As early as 1957, the Educational Policies Commission of the National Educational Association recommended that more effort be exerted "to appraise and credit growth resulting from a student's own initiative" (p. 54).

Some of the recent studies of acknowledged creative persons who have made outstanding scientific, literary, artistic and other contributions to society also present a strong case for developing in children the motivations and skills for self-initiated learning. In her study of eminent scientists, Anne Roe (1952) found that what decided almost all of her subjects on their career was a project in which they had been given freedom to find out things for themselves and once the joys of freedom were tasted, they never lost the zest. Roe concluded that the most important single factor in the making of the creative scientist is the need and ability to develop personal independence to a high degree. This independence factor is emphasized by numerous other findings in Roe's studies -- her subjects' preference for teachers who let them alone and their satisfactions in a career in what, for the most part, they follow their own interests without direction or interference.

Other studies (MacKinnon, 1962; Goertzel and Goertzel, 1962; Compton, 1953) of eminent creative scientists yield similar indications. Compton reports that one of the most pervasive characteristics of the Nobel prize winners is their exceptional self-starting ability. He also found that they had worked under conditions of substantial freedom and leisure and in an atmosphere where the kind of work in which they are creative is recognized as important.

In searching for some way to assess, in part, the motivation and skill to learn on one's own, it seemed to us that this goal would be reflected in participation in creative activities on one's own during Christmas and summer vacations. These are periods during which most children have enough unscheduled time to initiate activities on their own.

We recognized, however, that two rather powerful forces would work against our finding significant differences in favor of the experimentals over the controls. We know many parents who seek deliberately to develop in their children during vacation periods the motivations and skills which they value and which they feel are neglected by the school. Thus, if the parents of children in the control classes recognized that their children were not being given as many experiences in creative thinking as their peers, they might be expected to encourage and provide opportunities for such experiences during the Christmas and summer vacations. Furthermore, many students of creativity emphasize the strong drive components of the creative process. Northrop (1953), for example, has suggested that the urge to create acts as a "thorn in the flesh" which must be removed for proper mental and personality functioning. The urge to actualize oneself is considered by Rogers (1959) to be the mainspring of creativity and demanding of resolution. Thus, children deprived of participation in creative activities during the regular school term might have a stronger drive to engage in creative activities during vacations than their peers who had many such experiences as a part of curricular activities. In spite of these strong forces, it was hoped by the creators of the experimental materials that participation in the guided, planned experiences in creative thinking would give the subjects in the experimental classes a strong enough advantage to offset these influences.

Procedures

As already described in Chapter 4, the "Things Done During Christmas Vacation" checklist was administered immediately after the Christmas vacation by the classroom teachers. Three of the teachers in the Richfield study failed to administer the checklist according to instructions. Thus, the data from these classes were not included in the analyses reported in this chapter. An examination of the delayed results obtained by these teachers, however, indicates that the results from these classes were in the same direction as those obtained from the other classes. Thus, it is unlikely that this deficiency has biased the results reported herein. The "Things Done During Summer Vacation" checklist was administered during the first week of school following the summer vacation. The percentage of subjects available for completing the checklists was almost the same as had been available for testing during the period of the experimental treatment.

Since, by the nature of the data, there was no "pre-test" situation, the approach to test the hypothesis posed in this chapter (pupils in the experimental and control groups engaged equally in self-initiated activities during their Christmas and summer vacations) had to be different from that used in previous chapters. Conclusions were drawn, therefore, on the assumption that the two groups were equal in their participation in creative activities on their own before the beginning of the experiment.

Results

To test the hypothesis that there is no difference between the participation of the experimental and control groups in self-initiated creative activities during Christmas and summer vacations, two-tail t-tests were performed in examining the differences between the means of the experimental and control groups on the two instruments used in this study. (See appendix for copies of the instruments.)

Table 12 includes the data for comparing the experimentals and controls on the mean number of activities reported on the "Things Done During Christmas Vacation" checklist in each of the three locations. It will be noted that in both the Richfield and Brunswick studies the subjects in the experimental groups engaged in a larger number of creative activities than their peers in the control groups. The difference in the Sioux Falls study was in the opposite direction but was not statistically significant.

Table 12

Comparison of Mean Number of "Things Done During Christmas Vacation" Reported by Subjects in Experimental and Control Groups in Richfield, Brunswick, and Sioux Falls

Group	Number	Mean	Variance	Difference Exp.-Control	t-ratio	Level of Significance
Richfield						
Experimental	286	34.57	440.70			
Control	358	29.99	404.25	4.58	3.22	<.01
Brunswick						
Experiment	91	36.66	481.18			
Control	90	29.80	493.15	6.86	2.09	<.05
Sioux Falls						
Experimental	93	31.16	320.01			
Control	59	36.14	542.81	-4.98	1.48	NS

The results for the "Things Done During Summer Vacation" checklist are presented in Table 13. Here, it will be seen that subjects in the experimental classes in Sioux Falls engaged in significantly more activities during the summer vacation than did their peers in the control

Table 13

Comparison of Mean Number of "Things Done During Summer Vacation" Reported by Subjects in Experimental and Control Groups in Richfield, Brunswick, and Sioux Falls

Group	Number	Mean	Variance	Difference Exp.-Contr.	t-ratio	Level of Significance
Richfield						
Experimental	329	67.09	1593.70			
Control	313	68.30	1541.44	-1.21	0.39	NS
Brunswick						
Experimental	72	60.35				
Control	81	60.41		-0.06	0.01	NS

Table 13 continued

Group	Number	Mean	Variance	Difference Exp.-Control	t-ratio	Level of Significance
Sioux Falls						
Experimental	82	59.12	101.24			
Control	43	46.35	100.73	12.77	2.13	<.05

classes. The differences between the responses of the experimental and control subjects in the Richfield and Brunswick studies were quite small and not significant.

While the number of activities reported during the Christmas vacation was about the same in all three localities, there are some interesting differences among the three localities in mean number of activities reported during the summer vacation. The Richfield children appear to have been the most active and the Sioux Falls children the least active. The Sioux Falls experimentals, however, reported almost identically the same mean number of activities as did the Brunswick children. It is possible, however, that the summer checklist favored the Richfield children and did not include some of the natural creative activities of the Brunswick and Sioux Falls children.

Since there had been no opportunity to item-analyze the checklists in advance, it was decided to conduct an item analysis of the summer activities checklist to pick up those items which showed large differences for the two treatments. Instead of using the total experimental and control samples, 100 completed checklists each were drawn randomly from the Richfield experimentals and controls. The items included in Table 14 showed significant differences in proportions between the

Table 14

Items on the "Things Done During Summer Vacation" Checklist Which Differed Significantly for the Experimental and Control Groups

Number		Item	
Exper.	Control		
31	48	11.	Thought up plans to celebrate a holiday or special event.
54	34	29.	Figured out how to operate some machine or gadget.
52	31	49.	Whittled or carved some object.
36	23	60.	Trained a tame animal or pet.
13	4	66.	Found a honey tree.
36	23	122.	Did tricks on a rope swing bar.

Table 14 continued

Number		
Exper.	Control	Item
54	38	125. Followed a river or river bank.
38	53	137. Looked at and identified stars.
38	21	149. Figured out a new trick.
17	29	156. Helped make plans for decorating the house for a special occasion.
29	43	174. Embroidered, knit, or wove some object.
38	16	188. Made puppets.
16	29	219. Noticed droplets of water on the outside of a glass of water.

experimental and control samples.

When operating at the .05 level of significance, one would ordinarily expect significant differences on twelve of the 240 items to arise from chance. Since only thirteen significant differences occurred, the record is little better than chance. Nevertheless, let us assume that the thirteen differences presented in Table 14 did not arise from chance fluctuations. It will be noted that eight of the thirteen differences favored the experimental group. It will also be noted that there appears to be a certain kind of homogeneity among the items favoring each group. The items favoring the control group appear to be more structured and academic in nature (celebrating holidays, identifying stars, decorating the house for a special occasion, embroidering or knitting, and observing droplets of water). The items which favor the experimentals appear to be of an adventurous nature and relatively non-academic, seeming more like play (figuring out how to operate a machine or gadget, whittling some object, training a pet, finding a honey tree, doing tricks, following a river, figuring out a new trick, and making puppets).

Conclusion

Although the evidence is not conclusive, there is definite support in favor of the experimental materials as a contributor to the encouragement of participation in self-initiated creative activities during Christmas and summer vacations. The evidence is somewhat stronger for Christmas than for summer vacation, however. In no case did the controls participate in a significantly larger number of creative activities than the experimentals. When a detailed analysis was made of specific activities, it was found that there was at least some tendency for the controls to be more active than the experimentals in more structured and academic kinds of creative activities and for the experimentals to be more active than the controls in adventurous and unstructured activities.

Chapter 8

ACHIEVEMENT OF TRADITIONAL EDUCATIONAL SKILLS

The evaluation of experimental programs in education usually suffers from one or both of two general faults. Either the evaluation brings into consideration only traditional measures of achievement which are rarely appropriate to the goals of the experimental program or consideration is given specifically to the new or unique goals of the experimental program and there is a failure to give attention to what happens to the development of the usual kinds of achievement. The tests of creative thinking, the "How I Like School" inventory, and the creative activities checklists were introduced in an attempt to assess some of the new or unique goals of the experimental materials developed and tested through this project. Attention was also given to the results obtained from the standardized achievement tests in use by the school systems participating in the study.

Two of the school systems, Richfield and Sioux Falls, included in their regular evaluation programs the Iowa Tests of Basic Skills. These tests, it will be recalled, attempt to assess the development of educational skills such as vocabulary, reading comprehension, language skills, work-study skills, and arithmetic skills. They do not attempt to assess achievement of a subject-matter type in subjects such as history, geography, and the like. The other school system, Brunswick, regularly uses the California Tests of Achievement which yield scores on reading vocabulary and comprehension, arithmetic reasoning and fundamentals, and English mechanics and spelling. An analysis was made of the pre- and post-training test results from all three settings to determine whether or not the experimental procedures interfered with the achievement of these skills.

The most that the creators of the instructional materials hoped for was that the guided, planned experiences in creative thinking would not interfere with the achievement of these traditionally evaluated skills. In designing both the audio-tapes and the teachers guides, care was exercised to provide materials which could be used by teachers to bring about growth in vocabulary, the motivation to do more reading and writing, and experiences in reading and writing. Much material was provided for the development of work-study skills. Primarily, however, these were investigatory and creative thinking skills rather than the more traditional kinds of study skills. Little or no attention was given to arithmetic and spelling skills. It was clear from the reports of the teachers that some of them saw the experimental materials as tools for developing educational skills while others saw them only as an interference with the acquisition of these skills.

Results

All scores were reported in terms of standard grade norms. A score of 40.00 means that a pupil's achievement is equivalent to that of the average pupil at the beginning of the fourth grade; a score of 50.00, that his performance is equivalent to that of the average child at the beginning of the fifth grade. These grade norms were based on national samples and were prepared by the test publishers.

Table 15

Analysis of Covariance Results on the Iowa Tests of Basic Skills for the Richfield Sample.

	Means of Experimentals			Means of Controls			
Achievement Variable	Pre-	Post-	Adj. Post	Pre-	Post-	Adj. Post	F-ratio
Vocabulary	53.53	64.81	64.08	51.91	65.58	66.34	1.82
Reading Comprehension	51.22	64.23	63.64	49.98	63.94	64.56	1.62
Language Skills	52.48	67.76	67.25	51.54	67.59	68.13	1.78
Work-Study Skills	50.09	62.05	61.82	49.64	62.32	62.55	2.48
Arithmetic Skills	48.40	56.86	56.65	47.90	57.36	57.59	5.79*
Total for Battery	51.13	63.21	62.69	50.18	62.98	63.52	4.33*

Note: * F-ratio is significant at the .05 level, (1, 644) *df*.

The analysis of covariance results on the Iowa Tests of Basic Skills are reported in Table 15 for the Richfield sample. This table includes the pre- and post-test means and the adjusted post-test means for both the experimental and controls and the F-ratios resulting from the analysis of covariance. It will be noted that of the subtests, only arithmetic skills shows a significant difference between the experimental and control group on the adjusted post-training means. Since all of the subtests are consistently in favor of the subjects in the control classes, the cumulative effects make the total score significant at the .05 level of confidence.

It could be argued that the use of the experimental materials in the Richfield classes interfered somewhat with the acquisition of the traditional educational skills. Since it was apparent from the reaction reports of the teachers that some of them did little more than play the audio-tapes, it is reasonable to expect that in such cases the experimental materials did serve as an interference with rather than as a facilitator of the development of educational skills. Separate analyses need to be made of the achievement of pupils taught by teachers who really used the materials as teaching aids and that of pupils taught by teachers who attempted to use them "like a machine" without trying to integrate them with the ongoing curriculum. It should also be recognized that the experimental teachers were selected randomly from the total group of fourth graders. If volunteers had been accepted as experimental teachers, there would perhaps have been greater involvement of the teachers in the use of the audio-tapes and related materials as teaching aids.

Even if we accept the conclusion that the use of the audio-tapes interfered with the acquisition of traditionally valued educational skills, the loss was certainly not severe. Pupils in the experimental classes made an average gain of 1.108 grades during the period of the project. This is at least "normal" progress. The average gain of the control classes was 1.38 grades and thus not very impressive when compared with the gains of the experimentals.

The analysis of covariance results for the Brunswick sample on the California Achievement Tests is included in Table 16. Here it will be

Table 16

Analysis of Covariance Results on the California Achievement Tests for the Brunswick Sample

Achievement Variable	Means of Experimentals			Means of Controls			F-ratio
	Pre-	Post-	Adj. Post	Pre-	Post-	Adj. Post	
Reading Vocabulary	58.42	66.55	64.76	54.28	62.24	63.99	0.27
Reading Comprehension	51.60	64.76	63.11	47.85	58.54	60.14	4.09*
Reading Total	54.73	65.94	64.24	51.21	60.66	62.32	2.77
Arithmetic Reasoning	48.10	61.96	61.41	46.59	61.79	62.32	0.43
Arithmetic Fundamentals	44.71	58.56	59.20	47.59	57.31	56.69	3.67
Arithmetic Total	46.17	60.47	60.08	47.26	59.16	58.78	2.60
English: Mechanics	58.14	71.36	71.61	58.78	64.90	64.66	17.07**
English: Spelling	56.23	65.05	63.30	50.06	58.24	59.95	3.86
English: Total	57.05	68.35	67.13	53.56	62.65	63.83	6.61*
Battery Total	52.54	64.95	64.31	51.08	60.49	61.11	11.52**

Note: * Significant at the .05 level of confidence
** Significant at the .01 level of confidence
(1, 155 *df*)

observed that the results are opposite to those obtained in the Richfield study. Except in the case of arithmetic reasoning, the results consistently favor the experimentals. The differences are statistically significant in the case of reading comprehension, English mechanics, English total, and battery total. Thus, the sum of the effects of the experimental procedures in the Brunswick sample is not one of interference but rather one of facilitation, especially in the areas of reading comprehension and English skills. The reaction reports of the Brunswick teachers indicate that they were especially sensitive to the opportunities created by the audio-tapes for motivating writing and reading activities.

The analysis of covariance results on the Iowa Tests of Basic Skills are presented in Table 17. It will be noted that there are no statistically significant differences between the adjusted post-training means on any of the measures. Thus, it seems clear that the experimental procedures neither interfered with nor facilitated the achievement of the traditionally valued education skills. It will be noted however, that the educational level of the Sioux Falls subjects are somewhat lower in general than that of the Richfield and Brunswick subjects. They are, nevertheless, "up to grade level." The subjects in the Richfield and Brunswick studies were about a grade ahead of the expected level according to the national norms in use.

Table 17

Analysis of Covariance Results on the Iowa Tests of Basic Skills for the Sioux Falls Sample

	Means of Experimentals			Means of Controls			
Achievement Variable	Pre-	Post-	Adj. Post	Pre-	Post-	Adj. Post	F-ratio
Vocabulary	46.49	54.34	54.35	46.53	53.62	53.59	1.05
Reading Comprehension	44.92	52.63	52.75	45.29	53.17	52.94	0.96
Language Skills	47.06	56.53	55.23	44.03	52.94	55.37	1.24
Work-Study Skills	44.54	50.80	50.92	44.81	52.21	51.99	1.25
Arithmetic Skills	44.58	49.47	50.22	45.59	49.67	49.17	1.00
Total for Battery	45.59	52.76	52.55	45.08	52.36	52.77	1.21

Conclusion

The results presented herein that the experimental guided, planned experiences in creative thinking do not necessarily interfere with the development of the traditionally valued educational skills. Whether the materials interfere with, facilitate, or fail to affect the development of educational skills apparently depends upon the way in which the teacher uses the materials to reinforce and supplement the curriculum and how well teachers pursue through their usual methods the development of such skills as arithmetic computation and reasoning which are given little or no attention in the guided, planned experiences in creative thinking as they are now constructed.

Chapter 9

ABILITY OF TEACHERS TO IDENTIFY CREATIVE TALENT

In the process of developing the Minnesota Tests of Creative Thinking and trying to validate them against various types of criteria, teacher nominations and ratings were used on several occasions. It was found that some teachers were very accurate in their selection of the most and least creative children in their classes on the various criteria appropriate to the scores yielded by the tests (fluency, flexibility, originality, and elaboration). In some cases, however, there was no relationship between the nominations of the teachers and the scores of those nominated as high or low on the various criteria. In fact, there were negative relationships in a few cases. On the basis of our observations, it seemed that those teachers who provided experiences in creative activities and ways of learning were rather accurate and those who provided few such opportunities were inaccurate. In other words, it seemed that teachers were able to identify creative thinking abilities in their pupils if they gave their pupils adequate opportunities for manifesting such abilities. In the present project, it was assumed that pupils in the experimental classes would be given more opportunities for creative activities and creative ways of learning than their peers in the control classes. Thus, it was proposed that one of the side benefits of the experimental procedures would be an increased ability on the part of the experimental teachers to identify various types of creative talent among their pupils.

It will be recalled that at the end of the experiment teachers were asked to name the five children in their class which they considered the most fluent and the five which they considered the least fluent. To assist them, they were supplied with a brief description of the concept of "fluency." The same was done for flexibility, originality, and elaboration. A copy of the data collection device is included in the appendix.

Results

The null hypothesis set up to examine the comparative accuracy of the nominations was that the two groups of teachers (experimental and control) nominated with equal accuracy.

Nominations were obtained from the Richfield and Brunswick teachers only. The response of the teachers was highly encouraging in that most of them returned their nominations readily. Of course, some of them nominated three or four pupils instead of five as requested, but this is not really crucial and is taken care of in the analysis described below.

Several approaches to the analysis seemed possible but the one actually adopted--that of comparing the means of the pupils nominated on a particular variable by the two groups of teachers--seemed more meaningful and convenient than the other approaches available. Here we have a 2 x 2 lay-out as shown below:

	Teachers	
	Experimental 1	Control 2
Most	T11 n11	T12 n12
Least	T21 n21	T22 n22

Each cell in the figure shows the number, nij, of the students nominated by one of the two groups of teachers (i dimension) under one of the two subgroups (j dimension) most and least on a given variable or criterion (fluency, flexibility, originality, and elaboration), and Tij, is the total of the scores of the pupils so nominated. The total score, Tij, had been obtained from scores on the Abbreviated Form V11 of the Minnesota Tests of Creative Thinking by adding together the verbal and non-verbal components of each variable.

To the above set-up a two-way analysis of variance with disproportionate frequencies per cell was applied. The results for the Richfield teachers are reported in Tables 18, 19, 20, and 21. Corresponding analyses for the Brunswick teachers' nominations were not made because of the small number of teachers involved.

Table 18

Two-Way Analysis of Variance Results for the Richfield Teachers' Nominations on the Fluency Criterion

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square	F-ratio	Level of Significance
Between rows	1	4313.75	4313.75	14.98	<.01
Between columns	1	17.28	17.28	0.06	NS
Interaction	1	477.66	477.66	1.55	NS
Error	201	57866.59	287.89		

Table 19

Two-Way Analysis of Variance Results for the Richfield Teachers' Nominations on the Flexibility Criterion

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square	F-ratio	Level of Significance
Between rows	1	621.44	621.44	8.08	<.01
Between columns	1	101.09	101.09	1.31	NS
Interaction	1	13.02	13.02	0.17	NS
Error	186	14309.30	76.93		

Table 20

Two-Way Analysis of Variance Results for the Richfield Teachers' Nominations on the Originality Criterion

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square	F-ratio	Level of Significance
Between rows	1	5146.38	5146.38	16.15	<.01
Between columns	1	22.99	22.91	0.07	NS
Interaction	1	175.35	175.35	0.55	NS
Error	198	63110.63	318.74		

Table 21

Two-Way Analysis of Variance Results for the Richfield Teachers' Nominations on Elaboration

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	F-ratio	Level of Significance
Between rows	1	2373.93	2373.93	1.48	NS
Between columns	1	14165.62	14165.62	8.83	<.01
Interaction	1	95.94	95.94	0.06	NS
Error	192	308025.52	1604.30		

From Tables 18, 19, 20, and 21 it will be observed that the teachers were successful in nominating two groups of pupils each on fluency, flexibility, and originality who differed significantly on their scores on these variables. They were not successful in nominating as high elaborators a group that differed in their elaboration scores from those pupils they nominated as their poorest elaborators. The only significant difference between the two groups of teachers occurred in relation to elaboration, however. The experimental teachers were somewhat less successful than the control teachers in discriminating between the good and poor elaborators, as identified by the tests. Neither group was very successful in this regard, however.

The analysis was also conducted in a different way, to find out directly whether the "most" able pupils as nominated by the two groups of teachers had different mean scores on each of the variables. The corresponding inquiry was made concerning the "least" able pupils as nominated by the teachers. The results are presented in Table 22.

Table 22

Comparison of the Mean Scores of Pupils Nominated as High and Low on Four Different Criteria of Creative Thinking For Experimental and Control Groups in Richfield Study

Criterion Variable	Highest on Criterion: Experimentals No.	Mean	S. D.	Controls No.	Mean	S. D.	t-ratio
Fluency	41	65.20	16.96	64	62.88	11.15	0.85
Flexibility	37	34.08	6.19	61	33.08	9.76	0.56
Originality	39	44.97	17.28	66	46.14	17.34	0.33
Elaboration	40	80.63	38.31	65	64.47	39.04	2.07*

Table 22 continued

Criterion Variable	Lowest on Criterion: Experimentals No.	Mean	S. D.	Controls No.	Mean	S. D.	t-ratio
Fluency	35	52.14	17.33	65	55.95	21.03	0.92
Flexibility	32	31.16	8.77	60	29.07	9.04	1.07
Originality	37	37.27	19.80	60	34.58	17.52	0.70
Elaboration	35	75.43	50.07	56	56.39	35.14	2.19*

*Significant at the .05 level of confidence

It will be noted from this table that the results remain basically the same as in the first analysis. Again, elaboration is the only variable for which the differences are statistically significant at the .05 level of confidence.

The hypothesis was then examined from an entirely different angle. The question was asked directly: "Is a nominated pupil a "hit" or "miss" in terms of prediction?" In other words, has the pupil been identified by his teacher correctly or not? This required the use of an external criterion against which the accuracy of the nominations could be judged. The post-test scores (totals of the verbal and non-verbal components on each variable) on Abbreviated Form VII of the Minnesota Tests of Creative Thinking provided such a criterion on which each class of pupils was divided into high, middle, and low equal sub-groups. The teacher nominations were compared with the high and low groups. If a pupil nominated by his teacher as a "most" happened to be in the high sub-group, he was called a "hit." If his score placed him in the middle or low sub-groups, he became a "miss." However, if he did not have a test score at all, he had to be excluded from consideration. Similar procedures were applied to pupils nominated as "leasts." The results obtained are presented in Tables 23 and 24 for the Richfield and Brunswick teachers respectively.

Table 23

Comparison of the "Hits" and "Misses" Among the Richfield Teachers' Nominees, Judged Against the Four Post-Test Scores on the Test of Creative Thinking Ability

	Fluency		Flexibility		Originality		Elaboration	
Category	Exp'l.	Contr.	Exp'l.	Contr.	Exp'l.	Contr.	Exp'l.	Contr.
Hits	26	40	21	48	28	49	30	41
Misses	50	93	47	73	47	77	44	80

Note: Chi square (Fluency) = 0.38; (Flexibility) = 1.45; (Originality) = 0.05; (Elaboration) = 0.88.

Table 24

Comparison of the "Hits" and "Misses" Among the Brunswick Teachers' Nominees, Judged Against the Four Post-Test Scores on the Test of Creative Thinking Ability

	Fluency		Flexibility		Originality		Elaboration	
Category	Exp'l.	Contr.	Exp'l.	Contr.	Exp'l.	Contr.	Exp'l.	Contr.
Hits	9	6	9	9	8	12	5	5
Misses	16	19	20	18	16	12	18	18

Note: Chi Square (Fluency) = 0.88; (Flexibility) = 0.03; (Originality) = 1.37; (Elaboration) = 0.00.

Obviously, the null hypothesis cannot be rejected in any of the eight cases. It may be inferred, therefore, that the teachers using the guided, planned experiences in creative thinking do not show any better ability to judge the creative thinking abilities of their pupils than their counterparts who did not use these experimental materials. One wonders, of course, why this is true. Several possible explanations might be examined. First of all, the assumption that pupils in the experimental classes were given more opportunities for participation in creative activities and creative ways of learning may be questioned. In those cases where the teachers merely played the audio-tapes and actually failed to use them such an assumption could certainly be questioned. Or it could be that the experiences provided did not give opportunities to pupils to demonstrate visibly their creative thinking. Thus, teachers may have had no better opportunity to perceive manifestations of creative thinking ability than did their peers under the control conditions. There may also be some question about the genuine understanding of the teachers, both experimental and control, of creative thinking. In discussions with teachers, it has been a common observation of the Principal Investigator that they show little awareness of the fluency, flexibility, originality, and elaboration of the thinking of their pupils, even when such behaviors are clearly manifested in classroom activities. In general, fourth-grade teachers are so content-oriented that they pay little attention to the thinking processes of their pupils and appear to have little understanding of the functioning of the human mind.

It was thought that one possible explanation of the results reported in this chapter might lie in the fact that teachers are verbally-oriented and that the non-verbal scores combined with verbal scores might be introducing needless error into the situation. Verbal and non-verbal scores were then separated and the results re-analyzed separately for verbal and non-verbal scores on fluency, flexibility, originality, and elaboration. The results are essentially the same as reported in the foregoing tables using the combined scores. None of the differences are statistically significant.

Conclusion

The use of the experimental materials did not contribute to any improvement in the ability of the teachers using them to identify various types of creative talent, or perhaps more properly the various types of mental functioning believed to be involved in creative thinking.

Chapter 10

CAREER ASPIRATIONS

Many educators are beginning to recognize that they are educating children today for occupations which do not yet exist. Thus, it seems important that an increasingly larger proportion of our children be willing to entertain the possibility of working in unconventional occupations. Although the experimental materials did not encompass vocational guidance objectives, it was believed that the subtle influence of encouraging divergent thinking, studying the careers of eminent creative persons, and the like would encourage pupils in the experimental groups to think of careers in a greater diversity of fields, be less likely to insist upon working in the most popular or common occupations and more likely to consider the possibilities of unconventional occupations and occupations in the sciences. Although none of the eminent creative people who were the subjects of the dramas were from the creative arts, it was thought that the influence of participation in art activities and the respect for persons in diverse occupations might also possibly influence greater consideration of careers in the creative arts.

Procedures

The booklet which contained the creative thinking tasks includes a special blank for recording career aspirations. In administering the pre-test, many of the teachers failed to call attention to this blank and the pre-test data were not very complete. Greater caution was used in the administration of the post-test and in only three classes was there a failure to obtain career aspirations. Not counting those who failed to respond and those who indicated that they were undecided, a total of 540 choices were registered by the experimental subjects and 546 by the control subjects.

The career aspirations were first tabulated according to specific occupations such as: actor, airline stewardess, artist, athlete, barber, etc. In the science field, choices were tabulated as "scientist, unspecified" when no specific branch of science was specified but under specific labels (such as astronomer, geologist, oceanographer, etc.) when the specific branch of science was specified. The tabulations were then organized into the broader categories of interest in this chapter: popular occupations among fourth graders as determined by previous studies (Torrance, 1964a), creative occupations, unconventional occupations, science occupations, and arts occupations.

Popular occupations for boys included: professional athlete, carpenter, engineer, medical doctor, pilot, military (other than pilot), and astronaut. Popular occupations for girls are: housewife, nurse, teacher, and secretary.

Creative occupations for boys were defined to include: actor, artist, designer, lawyer, medical doctor, president of the United States, astronomer, writer or author, archeologist, chemist, petroleum scientist, space scientist, medical research scientist, frogman, skin diver, geologist, naturalist, salesman, test pilot, detective, college professor, manager, oceanographer, entomologist, architect, hunter, forester, explorer, judge, geneticist, and anthropologist. Creative occupations for girls included: actress, artist, designer, medical doctor, musician, astronomer, writer or author, zookeeper, interpreter, home economist, horse trainer, dancer or ballerina, singer, florist, and circus performer.

Unconventional occupations for boys were defined to include: actor, artist, designer, professional athlete, President of the United States, astronomer, poet, archeologist, tugboat captain, petroleum scientist, space scientist, agricultural scientist, medical research scientist, skin diver, frogman, test pilot, detective, car racer, TV engineer, oceanographer, entomologist, hunter, dog raiser, forest ranger, photoengraver, explorer, astronomer, archeologist, taxidermist, anthropologist, and fisherman. Unconventional occupations for girls included: actress, artist, designer, rancher, medical doctor, musician, scientist, circus performer, horse breeder, horse trainer, astronomer, poetess, pharmacist, Peace Corps worker, zookeeper, interpreter, Red Cross worker, singer, dancer, dentist, forester, parachutist, professional horsewoman, and dog breeder. The major criteria in classifying an occupation as unconventional were infrequency in the world of work and associations of non-conformity or social unconventionality. For example, "judge" meets the criterion of infrequency but not of associations of social unconventionality. On the other hand, "circus performers" are perhaps more numerous than "judges," but it is considered more unconventional to be a circus performer than to be a judge.

Results

The results of the foregoing analyses are presented in Table 25.

Table 25

Comparison of Career Aspirations of Pupils in Experimental and Control Groups According to Sex

Category of Career Aspiration	Sex	Experimentals			Controls			
		Total	Number	Percent	Total	Number	Percent	Chi sq.
Popular occupations among fourth graders	Boys	262	132	50.4	255	167	65.5	12.01**
	Girls	278	170	61.2	291	229	78.7	20.88**
Creative occupations	Boys	262	118	45.0	255	81	31.8	9.62*
	Girls	278	62	22.3	291	28	9.6	17.17**
Unconventional occupations	Boys	262	87	33.2	262	38	14.5	25.23**
	Girls	278	68	24.5	291	34	12.2	13.88**

Table 25 continued

Category of Career Aspiration	Sex	Total	Number	Percent	Total	Number	Percent	Chi sq.
Science occupations	Boys	262	41	15.6	255	28	11.0	2.44
	Girls	278	15	5.4	291	2	0.7	10.87**
Occupations in the arts	Boys	262	14	5.3	255	14	5.7	----
	Girls	278	31	11.2	291	21	7.2	2.65

Note: * Chi square is significant at the .01 level of confidence
** Chi square is significant at the .001 level of confidence

It will be noted that a larger proportion of the experimental boys and girls than of their counterparts in the control groups indicated career aspirations which were classified as creative and as unconventional and that a smaller proportion of them registered choices which were classified as popular or commonplace among fourth-grade pupils. A significantly larger proportion of the girls in the experimental groups than girls in the control groups named career aspirations in the sciences. The same tendency occurred among boys but the difference was not statistically significant. The differences on occupations in the arts are not statistically significant, although there is a tendency for a greater proportion of the girls in the experimental groups than in the control groups to name occupations in the arts.

These results suggest that the experimental procedures did serve either directly or indirectly to cause children to extend their horizons in regard to career aspirations. This is further supported by the fact that the boys in the experimental groups chose career aspirations in 67 different occupations compared to 41 for the control boys. The girls in the experimental groups chose careers in 39 different occupations compared to 26 for the girls in the control groups. There are many features of the experimental program which might be responsible for the generally greater divergency in career aspirations among the experimental subjects. First, the environmental atmosphere created might have made differentness in career aspirations more acceptable. Second, the inspiration of the careers of men like Edison, Franklin, Ford, Goddard, and others may have been partially responsible. Third, many efforts were made to stimulate the subjects to read about the careers of outstanding men and women and this may also have extended the horizons of some children. Fourth, the communication to children that their ideas are important may have contributed to a willingness to toy with the idea of working in an unconventional occupation.

It is interesting to note that the influence in the direction of occupations in the sciences seems to have been stronger than that in the direction of the arts. This is not unexpected since the dramas dealt with the careers of scientists and explorers and not with artists. This helps to reinforce the previous suggestions made by a number of educators concerning the inclusion of artist, musicians, writers, politicians, and the like. The experimental program was apparently fairly successful in making it acceptable for girls to consider careers in the sciences, although none of the dramas dealt with the science careers of women. Although the results for boys are not impressive on the surface, a closer examination of the data reveals a number of subtle influences not apparent in the data presented in Table 25. The boys in the control group tended to indicate an interest in a science career without specifying a specific area in science. Sixteen of their 28 science career choices (57 percent) were of this nature while only 11 of the 41 science career aspirations (27 percent) of the boys in the experimental groups fell into this category. The boys in the experimental group were more likely to say that they want to be "test pilots" while the controls were more likely to say that they want to be "pilots" or "jet pilots."

Chapter 11

SUMMARY AND CONCLUSIONS

The Problem

The project described in this report represents an attempt to contribute to the solution of two problems related to the development of the creative thinking abilities at the fourth-grade level:

1. The difficulties teachers experience in encouraging and guiding creative thinking experiences in the classroom and relating them to curricular content.

2. The development of ways for counteracting the numerous influences which bring about a slump in the creative thinking abilities, motivations, and activities at about the fourth grade.

In general, in-service education programs have proved relatively unsuccessful in solving these two problems. Such programs usually come at the end of busy and exhausting days in the classroom, making conditions for learning and motivation rather difficult. Previous attempts with workbooks or ideabooks embodying some of the principles of guided, planned experiences had been quite encouraging. A few pilot tests with audio-taped materials had also been encouraging. These too seemed to be most valuable when they became a part of a guided, planned experience in creative thinking.

Many observers at least since 1900 have observed a sharp decline in the creative thinking ability, creative motivations, and creative behavior in general at about the time a child enters the fourth grade. Most observers had assumed that this is a developmental phenomena about which little or nothing can be done. The Principal Investigator, however, has been unwilling to accept this assumption. Through intensive studies of two selected teachers, it was found that teachers by the use of deliberate methods can keep alive creative motivations and make the development of creative thinking abilities continuous. Through studies of the development of the creative thinking abilities of children in Western Samoa, Germany, India, Australia, and segregated Negro schools, it was found that the developmental curve assumes a different shape in different cultures. In some cultures, development is continuous. In some, the slump in creativity occurs in the fifth grade rather than in the fourth. In others, it occurs in the third.

There are a number of previous findings and observations that suggest that many problems of mental health, delinquency, school dropouts, and the like are related to the fourth-grade slump in creative development in our society. Mental hygiene and child guidance clinics seem to have a peak in referrals at about this time. Parents report more disturbing behavior in children at about this age. Many youngsters also develop a strong dislike for school at this stage and begin looking forward to the time when they will be old enough to leave school.

Although the Principal Investigator believes that much of the answer to keeping alive creative growth through the fourth grade lies in the relationship between the teacher and his pupils, he recognizes that changes in this area are difficult to achieve. One promising possibility presents itself in the form of specially designed instructional materials which provide planned, guided experiences in creative thinking. These materials should have built into them the best that we know from research about the creative process, the creative thinking abilities, the creative person, as well as what we know about the nature, interests, abilities, and problems of fourth-grade children. Applying the principles of guided, planned learning experiences Ojemann has shown that development can be quite different when children are provided planned learning experiences than when they experience only what the environment just happens to provide.

Although the investigators were able to find no accounts of deliberate applications of the guided, planned experiences concept to creative thinking, there are enough experiments of a related nature to indicate that such a possibility is possible and feasible.

It was concluded that the most obvious problem in constructing planned experiences in creative thinking is to provide materials which can be taught to ordinary pupils by ordinary teachers without special instructions.

Planned Experiences in Creative Thinking

Each of the twelve units of guided, planned experiences in creative thinking provides a planned sequence of experiences for developing the skills of creative thinking and suggestions for motivating fourth-grade pupils to participate in these experiences. At each stage of the sequence, a variety of possibilities are offered the teacher. Though teachers are encouraged to add or substitute their own ideas, a rich variety of possibilities for individual and group activities are suggested. Furthermore, the dramas and recorded lessons give the teacher even more tangible supports and extend her spontaneity.

An analysis of the learning task involved suggested that emphasis be given to the following major objectives:

1. To discover, motivate and develop creative awareness.

2. To develop an understanding of the nature and value of creative thinking and achievement.

3. To provide provocative data in the form of a dramatized supplement to the curriculum in the fields of science, history, geography, and the language arts.

4. To stimulate and guide creative behavior.

5. To create an awareness of the value of one's own ideas.

Although the content of the dramas and lessons were evenly divided among the fields of science, history, geography, and language arts, no planned sequence of activities fell within a single content area. For example, a science lesson might lead in turn to lessons in the visual arts, vocabulary building, creative writing, geography, and history. In order to assure maximum appropriateness of curriculum content, questionnaires were sent to selected curriculum leaders in the field of elementary education. As a consequence, the following titles were developed and used in the field tests:

Science Titles:

"Trailblazer to the Stars" (Robert Goddard)
"All-Around American" (Benjamin Franklin)
"Master of Miracles" (Thomas Edison)

History Titles:

"Eyes at Their Fingertips" (Louis Braille)
"Wizard on Wheels" (Henry Ford)
"Wings for the World" (Wright Brothers)

Geography Titles:

"Captains of Courage" (Lewis and Clark)
"Polar Pilot" (Richard Byrd)

Fantasy Titles:

"The Dog They Named King"
"Giovanni and the Giant"
"Christmas Minstrel"
"Sounds and Images"

In developing these materials it was assumed that the abilities and motivations involved in being creative are universal. Everyone possesses creative thinking ability to some degree and has needs or motivations which exert pressures in the direction of the use of these abilities. It was also assumed that these abilities are capable of being developed through educational experiences and that it is one of the school's legitimate functions to provide such experiences.

From the body of accumulated research, an attempt was made to identify some of the most relevant principles for guiding the development of these materials. The following are some of the ones identified and applied:

1. Value creative thinking.
2. Make children more sensitive and open to environmental stimuli.
3. Encourage guessing, experimenting, and manipulating.
4. Teach how to test systematically each idea.
5. Develop in children tolerance of new or divergent ideas.
6. Beware of forcing a set pattern.

7. Develop a creative classroom atmosphere.
8. Teach the child to value his creative thinking.
9. Teach the skills of avoiding unnecessary punishment for creative behavior.
10. Give information about the creative process.
11. Dispel the sense of awe of masterpieces.
12. Encourage and give credit for self-initiated learning.
13. Create "thorns in the flesh" or problem awareness.
14. Create necessities for creative thinking.
15. Provide for active and quiet periods.
16. Make available resources for working out ideas.
17. Encourage the habit of working out the implications of ideas.
18. Develop habits of constructive criticism.
19. Encourage acquisition of knowledge in a variety of fields.
20. Develop adventurous-spirited teachers.

Each of the twelve audio-tapes revolve about the role of creative problem-solving, the importance of courage and other personality characteristics necessary for creative achievement, and planned, guided experiences in creative behavior. In the recorded dramas, an effort was made to give pupils intimate insights into the thought processes which enabled men like Edison, Franklin, and the Wright Brothers to make important creative contributions. Much care was exercised to document the science, history, and geography stories with fidelity to historical fact. Primary sources were used to the extent possible.

A variety of production techniques were used in developing the audio-tapes. Some of the units make use of the "stop-tape" device, whereby the teacher may shut off the machine at one or more climactic moments and then request the class to provide possible solutions to the problem being encountered. After the class has responded, the story may proceed to the conclusion, thus allowing the pupils to compare their responses with the recorded solution or solutions.

In summary, the Great Moments of Discovery Series (science, history, and geography) was designed to acquaint fourth-grade boys and girls with the nature of the creative process and the value of original ideas and to motivate them to behave in creative ways through guided, planned experiences in creative thinking. The inclusion of the fantasy materials was based on the rationale that fantasy needs to be kept alive among children until their intellectual development is such that they can engage in sound types of creative thinking. Its inclusion represents an attempt to offset, to some degree, an excessive quest for certainty, safety, and objectivity so common among fourth graders.

Instruments Used in Evaluating Outcomes

An attempt was made to select instruments which would come closest to assessing the hypothesized outcomes of the experimental conditions resulting from the use of the guided, planned experiences in creative thinking which revolved about the audio-tapes. It was hypothesized that fourth-grade pupils under the experimental conditions compared with those under control conditions will:

1. Show greater growth as measured by a set of pre- and post-tests of creative thinking.
2. Like school better and find it more exciting.
3. Participate in more creative activities on their own.
4. Show as much growth in basic educational skills, as measured by a battery of standardized achievement tests at the beginning and end of the experimental period.

In addition, it was hypothesized that teachers using the experimental materials would be more successful than their colleagues at the end of the school term in differentiating between the most and least creative pupils in their classes. It was also hypothesized that pupils in the experimental classes would choose less commonplace and more creative occupations than their peers in control classes.

The following tests or other data collection devices were used for obtaining the data with which to test the hypotheses:

1. Abbreviated Form VII of the Minnesota Tests of Creative Thinking. This form was adapted for use in this study from earlier tests developed by the Principal Investigator and includes the following four tasks: incomplete figures, circles, product improvement, and unusual uses. Each task yields scores on fluency, flexibility, originality, and elaboration. The reliability and validity data on all four of these tasks have been quite encouraging. Each task attempts to sample different aspects of creative thinking.

2. Sounds and Images Test of Originality. The Sounds and Images recording consists of four sound effects, each of which is repeated in sequence three times. The sound effects range from simple to complex, from commonplace and familiar to unusual or strange. Administration of the test takes 18 minutes. Each repetition of a sound effect is followed by a brief pause for the subject to record in the appropriate space the word picture of the image each sound effect suggests. Responses are evaluated on criteria that yield a measure of originality (uncommonness of response).

3. Imaginative Stories Test. Each form of the Imaginative Stories Test consists of a suggested list of ten titles. Subjects are asked to select one of them or make up a similar one and to compose the most interesting and exciting story they can think about the topic within a time limit of 20 minutes. All of the titles involve animals or persons who possess some divergent characteristic or manifest some kind of divergent behavior. The stories were evaluated according to criteria which give measures of originality and interest.

4. How I Like School Inventory. The "How I Like School" inventory, developed by Cyril J. Hoyt, consists of 50 rather straightforward questions concerning liking or disliking for school, the teacher, etc. A score was obtained by adding all of the responses indicating a favorable attitude. In addition, analyses were made of specific items especially relevant to the aims of the study.

5. Creative Activities Checklists. Two checklists of creative activities were developed for use in this study. One of them was especially directed at ascertaining what creative activities were selected or initiated by the subjects of the study during the Christmas vacation. The other consisted of activities which were initiated during the summer vacation.

6. Achievement Tests. Pre- and post-training data were obtained concerning performances on the achievement test routinely given by the three school systems which participated in the study. Two of the school systems used the Iowa Tests of Basic Skills and the other used the California Achievement Tests.

7. Teacher Nominations Blank. At the end of the study, teachers under both experimental and control conditions were asked to nominate the five highest and five lowest pupils on each of the following criteria of creative thinking: fluency, flexibility, originality, and elaboration.

8. Teacher Reports on Audio-Tapes. Teachers using the experimental materials were asked to prepare a reaction report on each tape following the completion of the unit in which it was used. It consisted of the following questions:

How did your pupils react to the story?
Which single pupil seemed to show the greatest interest? In what way?
What did you feel was the most effective element in the dramatization?
How did your pupils react to the lesson which followed the dramatization?
Was the lesson suitable for your pupils in both lesson content and level?
What kinds of learning experiences or activities resulted, directly, or indirectly, from the playing of the tapes?
Do you have any suggestions as to how the tape might be made more educative for your class.

Experimental Procedures

The subjects of the study included 30 fourth-grade classes in the Richfield, Minnesota, Public School System totaling 800 pupils; six fourth-grade classes in Brunswick, Georgia, totaling 182 pupils; and six fourth-grade classes in Sioux Falls, South Dakota, totaling 155 pupils. Teachers in the Richfield and Brunswick studies were assigned randomly to the experimental and control conditions. In Sioux Falls, the experimentals were in one school and the fourth grades in similar schools served as the controls. The teachers in the experimental groups agreed to use the experimental audio-tapes and those in the control group were instructed to go ahead with whatever plans they has already formulated for their classes. Some of them had already worked out rather detailed plans for encouraging creative development.

At the beginning of the school term and before the experimental materials were introduced, the following assessment devices were administered:

1. Abbreviated Form VII of the Minnesota Tests of Creative Thinking
2. Imaginative Story Writing
3. Sounds and Images Test of Originality
4. How I Like School Inventory

Scores on achievement tests were obtained from the official school records. Immediately after the Christmas vacation, subjects in all three settings were administered the "Things Done During Christmas Vacation" checklist.

Except for holidays and vacations, a unit of the experimental materials was scheduled every two weeks, beginning with the completion of the pre-testing program. The intervention of holidays and vacations soon made it clear that only about 12 units rather than 16 could be comfortably scheduled during the school term.

Near the end of the school term and upon the completion of the experimental program, all classes were re-administered the assessment devices listed above. Alternate forms of the Imaginative Stories and Sounds and Images were used. The test of creative thinking and the "How I Like School" inventory were the same forms as had been administered in the previous fall. The "Things Done During Summer Vacation" inventory was administered the following fall at the end of the summer vacation.

The reaction reports of the teachers indicated that most of the teachers using the experimental materials improved gradually in their ability to use the audio-tapes effectively. Some of them achieved outstanding success almost from the beginning. Some of the teachers were resistant to using the audio-tapes throughout and it is clear that a few of them did nothing more than play the tapes to their classes. In almost all classes, the recorded dramas seemed to grip the imagination of the pupils. Response seems to have been especially good among boys, gifted boys and girls, and children who tend to be isolated and non-conforming. Response to the recorded lessons was also generally enthusiastic except in cases where the pupils had not been prepared in advance for the lesson and where motivation conditions were generally rather poor. A number of teachers indicated that some pupils who are not ordinarily well motivated became enthusiastic about some of the lessons.

RESULTS

Growth in Creative Thinking Abilities

First, statistical tests were run to determine whether or not growth took place on the ten measures of creative thinking. In the Richfield study, the controls showed losses rather than gains on four of the ten creativity variables and the experimentals showed gains on all ten. The Richfield experimentals showed statistically significant gains on eight of the ten measures and the controls showed statistically significant losses on one variable and gains on five of them.

In the Brunswick study, both the controls and experimentals showed gains on all measures. In all cases, these gains were statistically significant in the experimental group. In the control groups, the gains were statistically significant in nine of the ten cases.

In the Sioux Falls study, the experimentals showed gains on all ten measures (statistically significant in eight cases), and the controls showed losses in two cases and gains in the others (statistically significant in six cases).

In a second set of analyses, the post-test scores were corrected for pre-test scores and differences in means for experimentals and controls tested by means of the t-test. In the Richfield study, the experimentals proved to be superior to the controls on non-verbal fluency, non-verbal flexibility, non-verbal elaboration, and verbal originality and there were no reversals. In the Brunswick study, the experimentals were superior to the controls on non-verbal flexibility, verbal flexibility, and imaginative stories and the reverse was true in the case of non-verbal elaboration. In the Sioux Falls study, the experimentals excelled the controls on non-verbal flexibility and verbal elaboration and there were no reversals.

Thus, in spite of the fact that many of the teachers of the control classes used a variety of deliberate methods to encourage creative growth and some of the teachers of the experimental classes did not use properly the audio-tapes and auxiliary materials, the evidence is in favor of the experimental procedures.

Liking and Disliking of School

When the mean scores on the "How I Like School" inventory were analyzed, no statistically significant differences were found between the adjusted post-test means. When specific items of crucial interest in this project were examined, however, some interesting differences were revealed. Responses to the question, "Do you hate school?", are of special interest and possible significance. In the large Richfield sample, 17 percent of the experimentals and 21 percent of the controls answered "yes" on the pre-test, while 21 percent of the experimentals and 39 percent of the controls answered "yes" on the post-test. In the Brunswick sample, less than six percent of the experimentals answered "yes" to this question on the post-test, while over 12 percent answered "yes" in the control group. In the Sioux Falls sample, 12 percent of the experimentals and 18 percent of the controls answered "yes." In this sample, the proportion of children hating school in the experimental group decreased significantly while the proportion actually increased in the control group, though not significantly.

In the Brunswick sample, it was also found that a significantly greater proportion of the experimentals than the controls said that they enjoyed school and were invited to ask questions. In the Sioux Falls sample, a greater proportion of the experimentals than the controls expressed feelings of self-worth.

Another observation of possible significance is that 20 more of the experimentals were present for the post-test than for the pre-test while 27 fewer of the controls were present for the post-test than for the pre-test. Assuming that school attendance reflects in some way an interest in school and in learning, we have another point in favor of the experimental program.

Participation in Independent Creative Activities

In both the Richfield and Brunswick samples, the experimentals reported having engaged in a significantly larger number of creative activities during Christmas vacation than did their controls. In the Sioux Falls sample, the difference in means between the two groups was not statistically significant but was in favor of the controls. The results were reversed, however, for activities during the summer vacation. The Sioux Falls experimentals reported having engaged in more activities than their controls. In the Richfield and Brunswick samples, the differences were not statistically significant but were in favor of the controls.

In the Richfield sample, an analysis was made of the specific activities in the summer checklist. This analysis suggests that there was a difference in trends in the kinds of activities reported by the two groups. The items in the checklist favoring the controls appear to be more structured and academic in nature (celebrating holidays, identifying stars, decorating the house for a special occasion, embroidering or knitting, and observing droplets of water). The items which favor the experimentals seem to be of an adventurous and relatively non-academic and more playful nature (figuring out how to operate a machine or gadget, whittling some object, training a pet, finding a honey tree, doing tricks, following a river, figuring out a new trick, and making puppets).

Achievement of Traditional Educational Skills

In the Richfield study, there is some evidence that the use of the experimental materials may have interfered slightly with the acquisition of traditional educational skills as measured by the Iowa Tests of Basic Skills. The only area in which the difference is statistically significant is in arithmetic and even here the difference is of the magnitude of .094 years. In the Brunswick study, the evidence suggests that the use of the new materials actually facilitated the achievement of traditional educational skills, especially in reading comprehension and English mechanics. In the Sioux Falls study, there are no significant differences between the experimental and control groups on the post-test adjusted means. About one-half of the observed differences are in favor of the controls and the others are in favor of the experimentals.

In summary, the indications are that the use of the experimental materials may have interfered with the acquisition of traditional educational skills in one school system, facilitated their acquisition in another, and made no difference in the third. It would appear that whether the experimental materials interfere with, facilitate, or fail to affect the development of traditional educational skills depends upon the way in which the teacher uses the materials and how well he pursues his usual goals. It may well have been that the Richfield experimental teachers achieved important goals not assessed by these tests. Their pupils did achieve creative growth as measured by the tests of creative thinking, whereas the controls in some cases showed decrements between the beginning and end of the study.

Ability of Teachers to Identify Creative Talent

Using several approaches, little evidence was found to indicate that the teachers using the experimental procedures excel the teachers of the control groups in their ability to identify creative talent as measured by the tests of creative thinking. It was found, however, that both groups can differentiate high and low groups on fluency, flexibility, and originality which differ significantly on the relevant scores of the tests of creative thinking.

Career Aspirations of Pupils

A number of intriguing differences appear in the career aspirations of pupils in the experimental and control groups. Pupils in the experimentals choose a greater diversity of occupations. A smaller proportion of them than of the controls choose the most popular occupations for fourth graders. Larger proportions of them than of the controls choose creative occupations, unconventional occupations, and science occupations.

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BUREAU OF EDUCATIONAL RESEARCH
College of Education
Minneapolis 14, Minnesota

January 29, 1962

Dear Fourth Grade Teacher:

The University of Minnesota's Bureau of Educational Research is currently developing a set of audio tapes or discs designed for fourth grade use. Its purpose is three-fold: (1) to discover, motivate and develop creative awareness, (2) to provide a dramatized supplement to the curriculum, and (3) to stimulate creative thinking activities. Four of these tapes (or discs) will concern themselves with Great Moments of Historical Achievements. Another four will dwell upon Great Moments of Scientific Achievement. All eight of them will revolve about the importance of creative problem-solving and the principles of the scientific method as they relate to the fields of invention and discovery.

Since you as a fourth grade teacher might possibly use these tapes or discs in your own classroom sometime in the near future, we invite you to consider the following list of 30 titles and their synopses, and then indicate which of them you would like to see produced. Express your choices by placing checkmarks in the spaces provided in the left margin. Please check only eight titles -- four for each of the two divisions.

When you have indicated your eight choices, will you kindly return these titles -- at your earliest convenience -- by means of the self-addressed envelope enclosed?

Thank you very much for your kind cooperation!

History Titles (Moments of Discovery):

______ "Eyes in Their Fingertips," the story of how Louis Braille at the age of ten began developing in 1819 the remarkable Braille system, in which the sightless were given the power to read by means of a system of raised points and dots.

______ "From Reaper to Riches," the story of Cyrus McCormick's invention of the reaping machine in 1834, and how it revolutionized farming methods across America.

______ "The Silent Seamstress," the story of Elias Howe's invention of the sewing machine in 1845, and how it revolutionized the manufacture of clothing from Bangor to Bangkok.

______ "A Lesson for the Professor," the story of how young Professor Elihu Thompson, during an electrical demonstration before the Franklin Institute in Philadelphia in 1886, accidentally stumbled upon the principal of the process we know today as electric welding...and how from this discovery, industry entered a new age of progress.

______ "See 'em Move," the story of C. Francis Jenkins' invention in 1894 of the first truly satisfactory motion picture camera and projector, and how its development ultimately came to have tremendous impact upon the fields of entertainment and education.

______ "The Caterpillar That Made History," the story of how Benjamin Holt took his cue from the principle of the bicycle chain-drive to develop in 1903 the caterpillar tracter -- a vehicle indispensable to those areas where roads are lacking but wheeled vehicles can travel.

______ "The Night the Furnace Door Snapped," a dramatization of how John Spencer, a night watchman in a Maine sawmill, one night took his cue from the snapping of a furnace door to develop, in 1925, the modern thermostat.

______ "The Literary Piano," a dramatization of the events surrounding Christopher Sholes' development in 1868 of the world's first truly practical typewriter, and how it became an indispensable tool to world commerce.

______ "Bedrooms on Wheels," a dramatic account of how George Pullman's distaste for railroad sleeping accomodations led him to invent the famous Pullman sleeper in 1859, and how its development revolutionized rail travel the world around.

______ "Sing a Song of Streetcars," the tale of the development of the electric trolley from 1884 to 1877, in which inventors Van De Poel and Sprague collaborated to give America and the world the first horseless streetcar, and in the process changed the face of urban transportation all over the globe.

______ "The Invisible Beam," the story of the Taylor-Young collaboration in 1922 to produce the miracle of radar, a device whose manifold military and civilian applications are added to daily, to stand as one of the towering electronic achievements of the 20th century.

______ "The Plane That Couldn't Fly," a dramatization of the Edward Link invention in 1928 of a training machine for pilots -- the Link Trainer -- and how it contributed to the winning of World War II and to the peace of mind of millions of air travelers ever since.

______ "Louder, Please," a dramatization of the Lee DeForest development in 1907 of the audion tube, or radio wave amplifier, and how it became the great cornerstone upon which all modern radio transmission was to be built.

______ "From a Whisper to a Shout," the saga of the Rice-Kellogg development in 1924 of the dynamic loudspeaker, an invention which greatly amplified the feeble electrical and mechanical signals of the radio and the phonograph for millions of grateful ears all over the world.

______ "Pistol with a Payload," the saga of Sam Colt's invention of the revolver in 1835, and how it irrevocably altered the course of human events.

______ "The Iron Shark," the story of John Phillip Holland's development in 1891 of the world's first true submarine, and how it ultimately revolutionized naval warfare in a succession of steps from the crude submersibles of World War I to the remarkable atomic submarines of the present time.

______ "The Kite that Made History," the story of Benjamin Franklin's classical kite experiment of 1752, wherein he established conclusively the sameness of lightning and electricity.

______ "The Eli Whitney Story," a dramatization of events surrounding the invention of the Cotton Gin in 1793.

______ "Fulton's Folly," a drama concerning the invention of the steamboat in 1807.

______ "Chewing Gum and Bailing Wire," the story of the Wright Brothers' airplane, and how it flew that day in 1903.

Science Titles (Moments of Discovery)

______ "The Fortunate Accident," the dramatic tale of how a poor but determined experimenter, Charles Goodyear, one night in 1844 accidentally heated a mixture of sulphur and rubber gum, and discovered the principal of vulcanization -- the process which has been used ever since to impart rubber with the quality of hardness...and has made possible the gigantic growth of the rubber industry.

______ "The Little Black Box," the tale of how George Eastman in 1888 came to invent the Kodak camera, and how it quickly replaced the old-fashioned and cumbersome methods of the past with a swift, sure and simple system of picture-taking that was to popularize photography for the masses.

______ "From Matches to Magazines," the story of how General Benjamin Tilghman's idle chemical experiments following the end of the Civil War in 1866 accidentally produced paper pulp, a discovery which lead to the process of making inexpensive paper from wood, and in time revolutionized the paper, printing and publishing industries.

______ "Stop on a Dime," the saga of how an article in a magazine he didn't want to buy gave George Westinghouse the clue he was searching for in order to develop the compressed air brake in 1869, a device which has since contributed to the safety of unnumbered lives the world over.

______ "Send the Word," the story of how Samuel F. Morse perfected the magnetic telegraph in 1837, and how it provided a growing America with the swiftest means of communication known to the 19th century.

______ "Talk Here," the tale of Emile Berliner's invention of the microphone in 1877, and how it revolutionized the transmission of sound.

______ "Voices on the Wind," concerning Alexander Graham Bell's invention of the telephone in 1876.

______ "With a Flick of the Wrist," a dramatization of Thomas Edison's struggles to finally perfect the electric light in 1879.

______ "Get a Horse," the saga of Henry Ford's efforts to give America the world's first mass-produced automobile in 1908.

______ "Trailblazer to the Stars," the story of America's rocket pioneer, Robert Hutchings Goddard, and how in 1926 he developed the world's first liquid-fueled rocket, thus paving the way for the true conquest of space 30 years later.

Add other titles which you think would be especially appropriate for the fourth grade.

September 1962

Dear Richfield Fourth Grade Teacher:

Several of you who will be participating in the audio-tape projects, "Programmed Experiences in Creative Thinking," have raised some questions relating to the program since our general orientation meeting at Centennial School last week (August 28).

The following information has been prepared in an effort to answer these and other queries which may arise in the near future:

- Pre-Test Dates: Materials for the pre-test battery (including the "How I Like School" inventory, the verbal and non-verbal tests of creative thinking, etc.) will be distributed to your classroom shortly. To present as few inconveniences as possible, we have decided that it would be better for you to administer these tests personally, rather than dispatch personnel to your building at a pre-arranged time which might prove disruptive to your particular classroom schedule. You needn't plan on more than 1½ hours to administer the total testing battery and you can fit them into your program as your schedule permits.

- Available Tapes: The first tape, "Sounds and Images", a sound effects test of original thinking (Cunnington and Torrance, 1962) will be distributed to you through Mr. Heinrich's office during the week of September 10-14. This tape contains a series of provocative and stimulating sound effects, punctuated by recorded instructions which invite the listener to make guesses about them and later, use them as springboards to some creative art or language activity. We strongly urge you to play this particular tape ahead of the dramatic series to follow, for it will provide you and your class with an ideal introduction to "Programmed Experiences in Creative Thinking." In the meantime, it will provide us at the Bureau of Educational Research with topical criteria on the imagination, originality and creativity of your individual pupils.

Another five tapes -- the first block of 16 dramatic tapes you'll receive during the course of the school year -- will be distributed during the week of September 17-21. This package will contain the following:

1. "Trailblazer to the Stars," one of the Science series. The life story of Robert Goddard, 20th Century rocket pioneer, who laid the scientific foundations for modern rocketry by courageously testing and building on his ideas. Tape includes two pre-recorded lessons: a creative art and language exercise, in addition to one emphasizing the creative process as it relates to the scientific method.

2. "Captains of Courage," one of the Geography series. The saga of Lewis and Clark, and how from 1803 to 1805 they led a band of courageous explorers thousands of miles from St. Louis to the Pacific Ocean and back again to open up the vast Louisiana Territory. Tape includes two pre-recorded lessons: One relates to the art of making educated guesses, the other to general creative activity.

3. "The Dog They Named King," one of the Fantasy series. A young prince and a princess face a haunted forest and a wicked witch to bring their pet dog to safety. Tape includes two pre-recorded lessons: a creative writing exercise precedes the drama, and a creative art session follows.

4. "Eyes at Their Fingertips," one of the History series. The story of how Louis Braille at the age of 10 began to develop in 1819 the remarkable Braille system, by which the sightless were given the power to read by means of a system of raised points and dots. Tape includes a pre-recorded lesson relating to the invention of secret codes.

5. "Giovanni and the Giant," another of the Fantasy series. A cowardly woodcutter employs bluff, strategy and a fertile imagination to outwit a dangerous giant. Exercises related to creative problem-solving are integral with the story.

A manual will accompany each tape and will consist of:

1. A foreword concerned with the particular objectives to be sought in the administration of the unit,
2. General information about the drama itself,
3. Several suggestions and ideas related to the implementation of the various integrated lessons,
4. Selected supplementary readings for both teacher and pupil,
5. Production scripts for both the drama and the various accompanying lessons, and
6. A cast of characters involved in the production of the drama.

The second block of tapes will be made available shortly after November 1. These will include a Christmas fantasy, in addition to productions relating to the Wright Brothers (another in the Science series) and Benjamin Franklin (another in the History series). The Christmas tape will be scheduled for the week of December 3-7. No further tapes have been scheduled until the second week in January -- the first appropriate period available after the pre-Christmas activity of December and the subsequent Yuletide holidays. The Wright story has been suggested for January 7, while the Franklin tape has been scheduled for January 21.

- Tape-Testing Starting Date: The tape program should begin on or about Monday, September 17. A new tape should be introduced every other week thereafter. Accordingly, you should introduce the second tape unit on or about Monday, October 8.

- Suggested Playing Schedule: When playing the tapes, we suggest the following schedule:

1.	"Sound Effect Test of Originality"	on or about September 17
2.	"Trailblazer to the Stars"	on or about September 24
3.	"Captains of Courage"	on or about October 8
4.	"The Dog They Names King"	on or about October 22
5.	"Eyes at Their Fingertips"	on or about November 5
6.	"Giovanni and the Giant"	on or about November 19

This order is based on the progressive difficulty of the contents. We encourage you to adhere to it as closely as you feel you are able under your particular circumstances. However, it may be modified. Hence, you may wish at one time or another to substitute the playing of one tape for another to better correlate it with a particular unit of study you may have planned in advance. Such substitution is perfectly acceptable, if it will help you to reinforce your teaching program.

The important thing to keep in mind is that ALL the tapes must be played during the course of the experimental study. If they are not, their cumulative effect will be weakened, and the anticipated end-benefits your pupils will derive from them will be curtailed.

- Additional Materials: Also amorg the teaching aids to be provided shortly will be a "Tape Calendar," which will help you to keep accurate check of the suggested playing schedule. Space will be provided on this calendar in which you might wish to make notes of interesting or unusual creative activities that may develop during the course of the tape program.

- Addenda: One of the misconceptions which seemed to develop from our orientation session of August 28 was that "Programmed Experiences in Creative Thinking" might tend to burden rather than relieve your classroom schedule. If the materials you are about to receive are handled effectively, the opposite effect should occur. For these Programmed Experiences are intended to SUPPLEMENT the curriculum, in the four broad fields of Science, History, Geography (Social Studies) and the Language Arts. Moreover, because they have been designed as complete, self-contained lessons in and of themselves, they may be used as SUBSTITUTES for customary lesson units, thus relieving a part of the classroom load you generally carry. You should feel perfectly free, however, to adapt them to your program.

Lesson format constituted another question which grew out of the August 28 session. The format for the lessons will vary from tape to tape. A few of the productions will feature the so-called "stop-tape" principle used in "Giovanni and the Giant," which you heard last Tuesday. Others will employ the "finish the lesson" method, wherein a dramatized story is cut off in mid-stream, and the children are then directed to finish it themselves. Still others will use the dramas as springboards from which narrated lessons may depart.

We sincerely hope this memo will answer at least some of the questions you may have had regarding "Programmed Experiences in Creative Thinking." If during the course of the experimental program you should have further questions, please let us know. We shall be happy to answer them for you.

Best wishes for a successful school year!

B. F. Cunnington

E. Paul Torrance

ABBREVIATED FORM VII

MINNESOTA TESTS OF CREATIVE THINKING

Name____ Date______________

Age_____ Sex_____ Grade or Classification______________________________

School____ City______________

What kind of work would you like to do when you complete your education?

____

The four tasks in this booklet give you a chance to use your imagination to think up ideas. In two of these tasks you will be asked to put your ideas into words. In the other two, you will be asked to put your ideas into drawings, sketches, or figures. We want you to think of as many ideas as you can. Try to think of unusual, interesting, and exciting ideas -- something no one else in your class will think of.

You will be timed on each of these four tasks, so make good use of your time. Work as fast as you can without rushing. If you run out of ideas before the time is called, wait until instructions are given before going on to the next task.

Do not pay any attention to the rest of this page, but do not turn to the next page until told to do so.

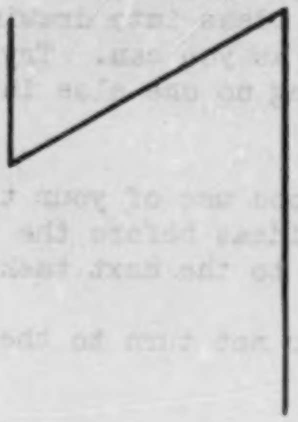
****

Scoring Category	Task 1	Task 2	TOTAL NON-V	Task 3	Task 4	TOTAL VERBAL	GRAND TOTAL
Fluency							
Flexibility							
Originality							
Elaboration							

Bureau of Educational Research
University of Minnesota
August 1962

TASK 1: FIGURE COMPLETION

By adding lines to the figures on this and the next page, you can sketch some interesting objects or pictures. Again, try to think of some picture or object that no one else will think of. Try to make it tell as complete and as interesting a story as you can by adding to and building up your first idea. Make up a title for each of your drawings and write at the bottom of each block next to the number of the figure.



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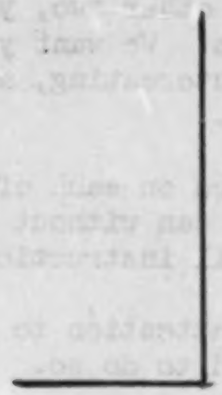

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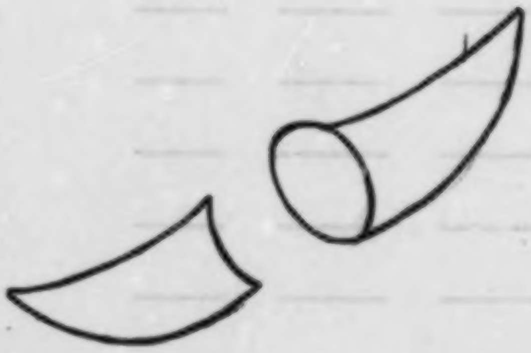

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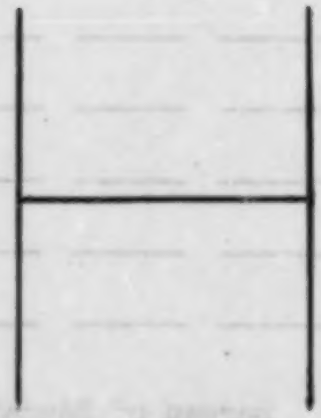

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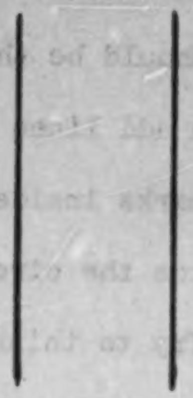

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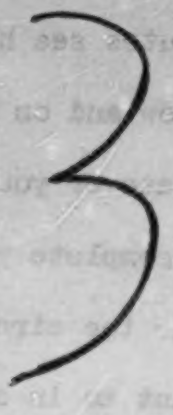

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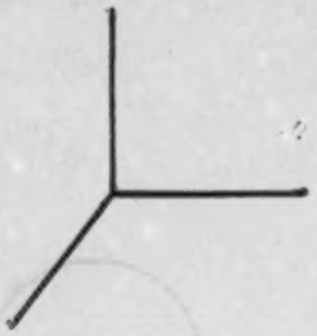

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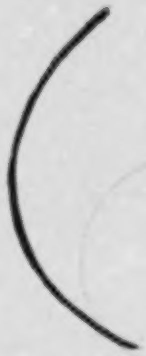

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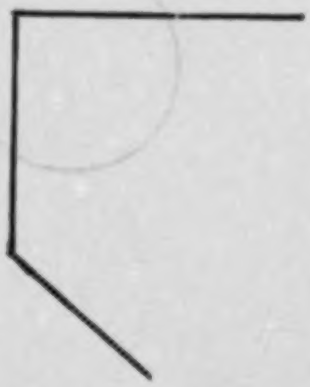

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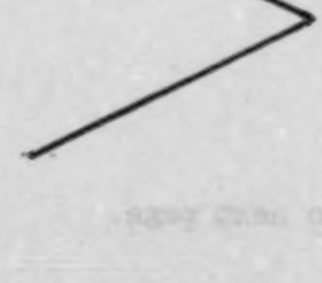
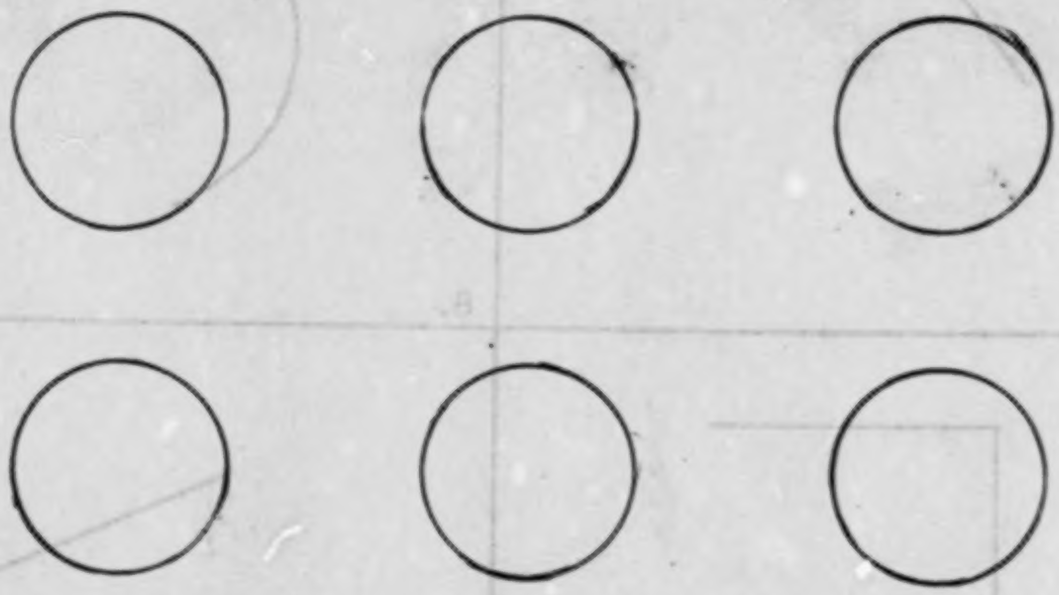


10.

TASK 2: CIRCLES

In ten minutes see how many objects or pictures you can make from the circles below and on the next page. The circles should be the main part of whatever you make. With pencil or crayon add lines to the circles to complete your picture. You can place marks inside the circles, outside the circles, or both inside and outside the circles -- wherever you want to in order to make your picture. Try to think of things that no one else will think of. Make as many different pictures or objects as you can and put as many ideas as you can in each one. Make them tell as complete and as interesting a story as you can. Add names or titles below the objects.



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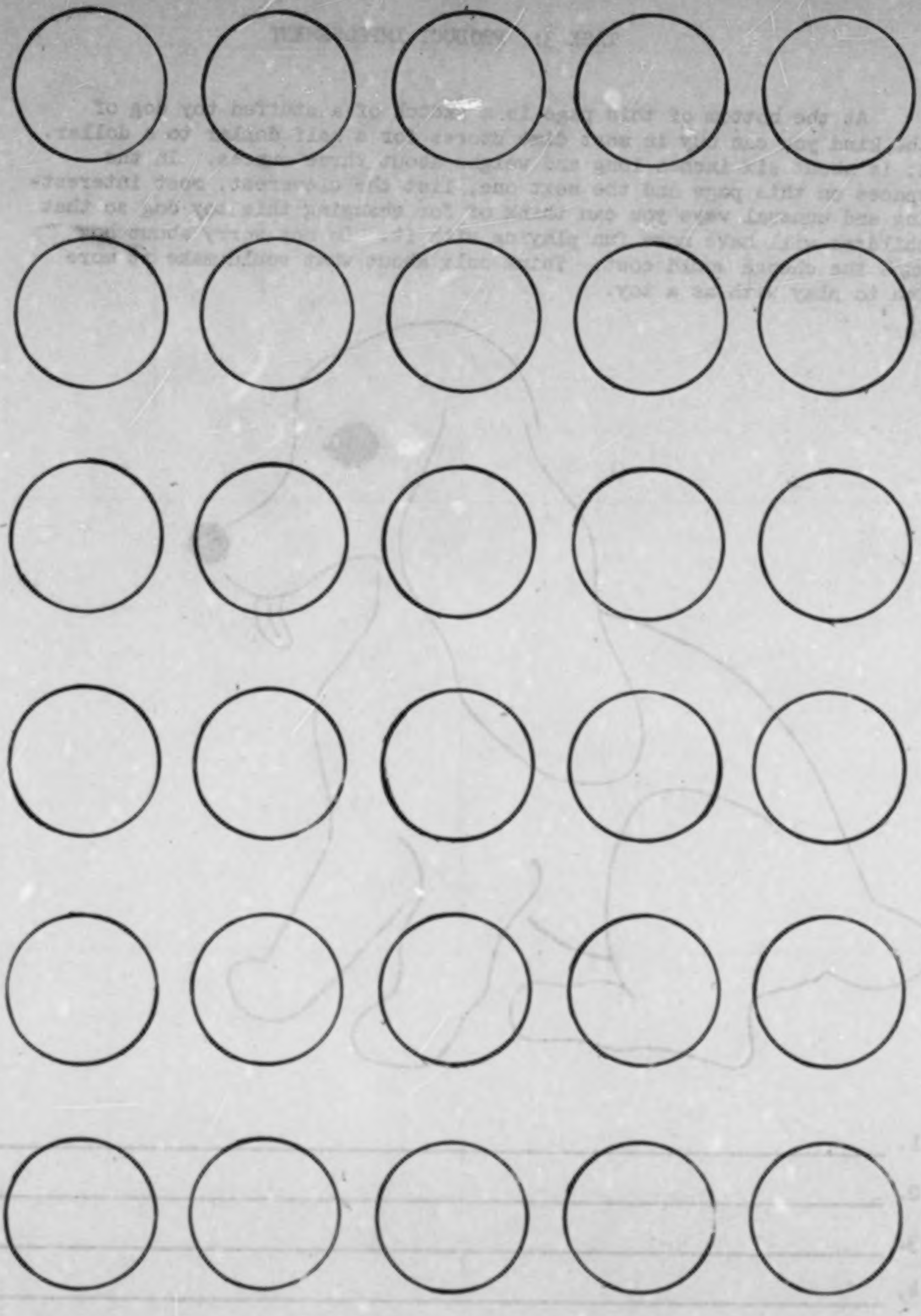
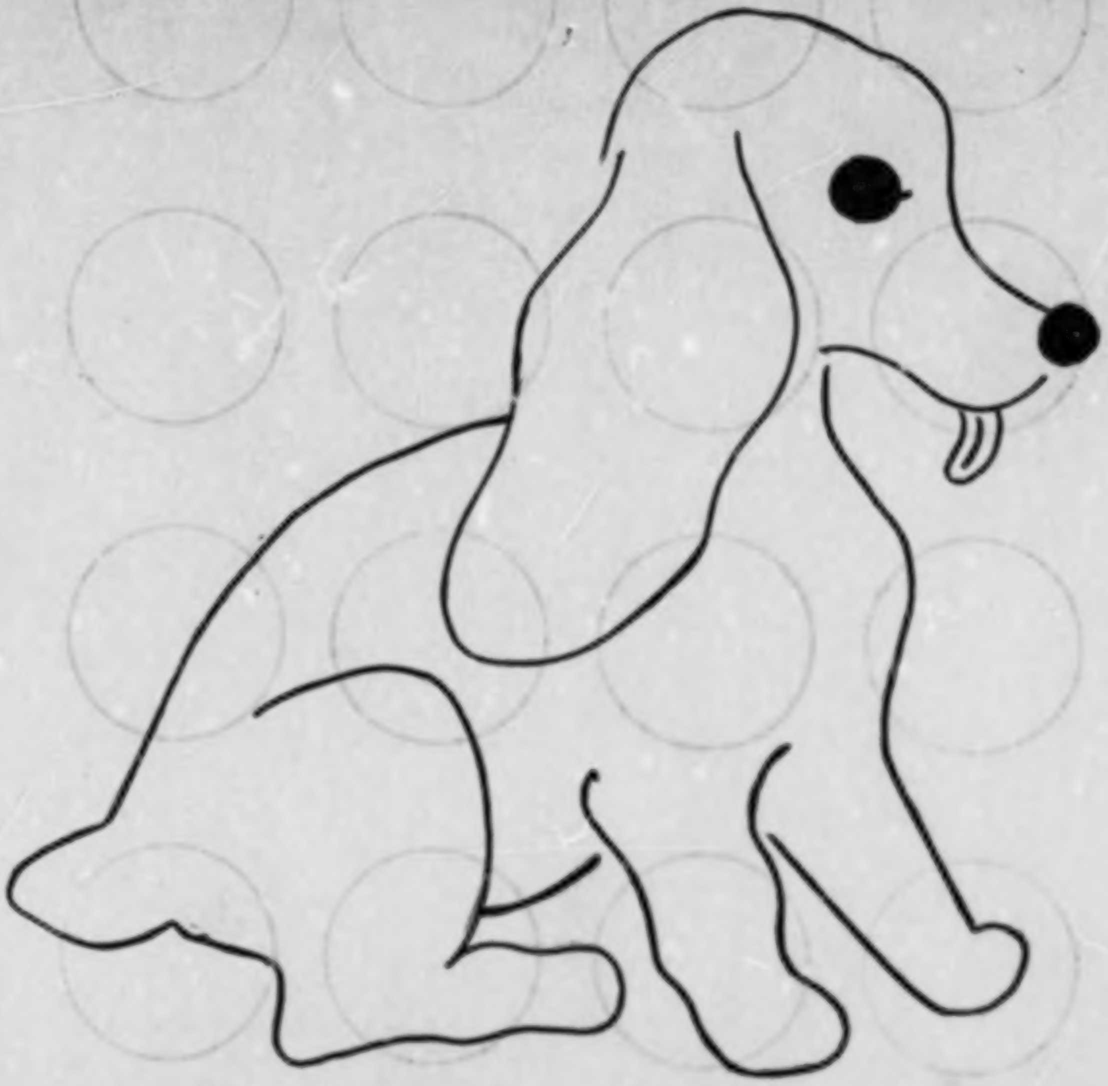


TASK 3: PRODUCT IMPROVEMENT

At the bottom of this page is a sketch of a stuffed toy dog of the kind you can buy in most dime stores for a half dollar to a dollar. It is about six inches long and weighs about three ounces. In the spaces on this page and the next one, list the cleverest, most interesting and unusual ways you can think of for changing this toy dog so that children will have more fun playing with it. Do not worry about how much the change would cost. Think only about what would make it more fun to play with as a toy.



1. ____
2. ____
3. ____
4. ____
5. ____

Turn to next page.

6. ______________________________

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30. ______________________________

31. ______________________________

32. ______________________________

TASK 4: UNUSUAL USES (Tin Cans)

Most people throw their empty tin cans away, but they have thousands of interesting and unusual uses. In the spaces below and on the next page, list as many of these interesting and unusual uses as you can think of. Do not limit yourself to any one size of can. You may use as many cans as you like. Do not limit yourself to the uses you have seen or heard about; think about as many possible new uses as you can.

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30. ____________________

31. ____________________

32. ____________________

33. ____________________

34. ____________________

35. ____________________

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44. ____________________

45. ____________________

46. ____________________

47. ____________________

48. ____________________

HOW I LIKE SCHOOL

Bureau of Educational Research University of Minnesota

The questions on this sheet ask you to tell what you like or do not like about school. Please answer them by making a circle around the YES or NO for each question. Do not stop long to think about any one question. If any one seems hard, go on to the next question and come back to it later. There are no right or wrong answers here. The answer you mark should tell just how you feel or think about the question.

How old are you? _____

What is your grade? _____

Are you a boy or a girl? _____

---

1. Is most school work interesting? YES NO
2. Do you feel important in school? YES NO
3. Do you feel you lose out if you miss school? YES NO
4. Do you like school? YES NO
5. Do you think your teacher likes the games you play? YES NO
6. Are you often unhappy in school? YES NO
7. Are you sometimes permitted to help others with their work? YES NO
8. When things are funny, does your teacher laugh also? YES NO
9. Is your teacher usually kind to you? YES NO
10. Is it easy for you to get help in school? YES NO
11. Are pupils often made to stay in for recess or after school? YES NO
12. Do most children in your room try to understand before they ask questions? YES NO
13. Do you like school most days? YES NO
14. Are you praised when you do good work? YES NO
15. Are you scolded when you do not know something? YES NO
16. Is the whole class often punished when only one or two pupils are to blame? YES NO
17. Is your school room a happy place? YES NO

(Go ahead to more questions on the other side of this sheet)

18. Is most school work explained so you can understand? YES NO

19. Are the children in your room nearly always treated fairly? YES NO

20. Are the children in your room allowed to ask questions? YES NO

21. Do most children in your room like to stay away from school? YES NO

22. Does your teacher keep her promises? YES NO

23. Do you like school very much? YES NO

24. Do you like to stay out of school? YES NO

25. Do you think your teacher likes you? YES NO

26. Does it seem that you always do poor work? YES NO

27. Do you get help when you do not know something? YES NO

28. Do you often have too much homework? YES NO

29. Do you enjoy school? YES NO

30. Are you proud to be in your school room group? YES NO

31. Do you like your teacher? YES NO

32. Are you invited to ask questions? YES NO

33. Do you like to talk to your teacher alone? YES NO

34. Are you afraid to ask questions? YES NO

35. Are most school days happy ones for you? YES NO

36. Are pupils punished in front of others? YES NO

37. Do you sometimes talk and joke with your teacher? YES NO

38. Are you often scolded in school? YES NO

39. Are you told when you do good work? YES NO

40. Do you help decide what the class does? YES NO

41. Are you often bossed in school? YES NO

42. Are your lessons explained well? YES NO

43. Are the children scolded often? YES NO

44. Are you scolded for mistakes in your work? YES NO

45. Is there always something wrong with your work? YES NO

46. Does your teacher seem to like children? YES NO

47. Are you afraid to ask for help? YES NO

48. Do you hate school? YES NO

49. Do most children in your room get the help they need? YES NO

50. Do you feel you are treated fairly in school? YES NO

CREATIVE WRITING (FORM A)

NAME______________________________GRADE___SEX_______DATE_________

SCHOOL____________________________________TEACHER________________

INSTRUCTIONS: In the next twenty minutes, we would like for you to write the most interesting and exciting story you can think of about one of the topics listed below. Try to write legibly but do not worry too much about your writing, spelling, and the like. Instead, try to put into your story as many good ideas as you can. Choose any one of the following topics or make up a similar one of your own:

1. The dog that doesn't bark.
2. The man who cries.
3. The woman who can but won't talk.
4. The cat that doesn't scratch.
5. Miss Jones stopped teaching.
6. The doctor who became a carpenter.
7. The rooster that doesn't crow.
8. The horse that won't run.
9. The duck that doesn't quack.
10. The lion that doesn't roar.

Write your story in the space below and on the attached sheet.

____

CREATIVE WRITING (FORM B)

NAME________________________________**GRADE**____**SEX**____**DATE**________

SCHOOL__________________________________**TEACHER**________________

INSTRUCTIONS: In the next twenty minutes, we would like for you to write the most interesting and exciting story you can think of about one of the topics listed below. Try to write legibly but do not worry too much about your writing, spelling, and the like. Instead, try to put into your story as many good ideas as you can. Choose any one of the following topics or make up a similar one of your own:

1. **The teacher who doesn't talk.**
2. **The hen that crows.**
3. **The dog that won't fight.**
4. **The flying monkey.**
5. **The boy who wants to be a nurse.**
6. **The girl who wants to be an engineer.**
7. **The cat that likes to swim.**
8. **The kangaroo that won't hop.**
9. **The lion that won't roar.**
10. **The cow that brays like a donkey.**

Write your story in the space below and on the attached sheet...

____

SOUNDS AND IMAGES, FORMS I AND II
(Without Word Cues)

NARRATOR: Today, you and I are going to do something a little different together, we're going to listen to sounds. At least one of these sounds may be familiar to you, and you'll probably recognize it straight off. The other sounds, though, are going to seem rather strange, and you'll likely scratch your head a bit as you wonder what they might be.

Now, this recording contains four separate sounds. Each sound will be repeated three times. As you listen to these sounds, try to picture them in your mind. Then -- write them down. Some of them, however, you won't recognize at all. You'll probably have a little trouble in picturing and describing them. These are the sounds I want you to use your imagination on, and write down the word pictures they make you think of.

Before you now is a sheet of paper on which has been printed 12 rectangles or spaces. Your job is to write down in these spaces the word pictures each sound suggests to you. For example, let's say that the first sound you hear suggests the ringing of an alarm clock. Your job then would be to describe the sound that way, in the first space in the top row. This row is labeled "A," and that first space is labeled "Number One." Now, let's say that the second sound you hear might suggest the noise of breaking glass. So, you would describe it that way in the second space, in the Space Number Two. Got it? When you have hear all four sounds...

and described each one..you will have filled in all the spaces in the top row. Then, the four sounds will be repeated again, and you will describe each one by filling in the four spaces across the second row, which is labeled row "B." Finally, the four sounds will be repeated once more, and this time, you will describe them by filling in the four spaces in the bottom row, labeled row "C."

Does it sound complicated? Actually, it will really be quite simple, and fun too, once we get going. Now, let's listen to those four sounds. There will be a brief period of silence between each of them, so that you will have time to describe each one. The first sound will be easy to describe, but the others are a bit mysterious, and are guaranteed to make you stop and wonder. As you listen to them, use your imagination while writing down the word pictures these sounds suggest to you. The chances are, the sounds will also call up many different feelings within you. Try to capture these feelings, and hold onto them long enough to write them down. Remember -- write down your impression of each sound, as it occurs in the recording. As you listen, fill in the spaces from left to right across row "A" -- the top row. Here we go, then, into the mysterious world of sound!

SOUNDS (each followed by a brief pause).

I'll bet that first sound was easy to describe, while the others really made you do some thinking. Now then, take your paper, and carefully fold it back along the top row, so that you have covered your answers. If you folded it correctly, row "B" should now appear at the top of the page. You see, I am going to play those sounds again, exactly as before. Only this time, I want different answers from you... and I don't want you to spoil the fun for yourself by peeking at your old answers.

I want you now to let your imagination FLY this time, so that even everyday sounds will take on new meanings for you. Thus, the thunderstorm may now seem to suggest something altogether different to you -- something wild and wonderful. And, as for those other sounds -- they will suggest other things to you now, too -- provided you let your imagination really soar, high as the sky. As you listen, fill in the next set of spaces from left to right across row "B". All set? Here we go again into the world of sound!

SOUNDS repeated

Did you get something new this time by letting your imagination wander further afield? Well, if you did, the chances are you had quite a bit of fun in the process.

Now, take your paper -- and, once again, carefully fold it back along the next row, so that you have covered your last answers. If you folded it correctly, row "C" should now appear at the top of the page. We're going to listen to those sounds once more now...and this time, the sky's the limit, for I want you to push the walls of your imagination out as far as they'll possibly go. Thus, that thunderstorm may now seem to suggest something totally different to you than it did on either of the other two rounds. And those other sounds will suggest more interesting things to you now, too -- much more interesting things -- provided, of course, that your imagination is alert and ready. Just remember -- the further you let your imagination carry you, the more fun you'll have. And as you listen, fill in the last set of spaces from left to right in row "C." Are you ready? Here we go once more, then, into the wonderful world of sound!

SOUNDS

I'll bet your answers this time REALLY had a different twist! Now then: take a look at all 12 of your answers. I want you to choose from them the one answer which you think is the most interesting of all -- and put a dark circle around it. Then, draw or paint a picture about that answer. And, if you have time, write a story to go with it. Be very careful to choose the one answer you think is the most unusual, though, because the more unusual the answer, the more unusual will be your picture or your story. And the more fun you'll have in the long run. Have a good time, now -- and good luck!

WORD-PICTURES FROM SOUNDS

Name______________________________________**Date:**______________________

Form: I____**II**____**Age:**_____ **Educ. Status:**______________________________

	Sound 1	**Sound 2**	**Sound 3**	**Sound 4**
A				
B				
C				

TEACHER REPORTS ON AUDIO-TAPES

Name______________________________ School______________________ Date____________

As you play the tapes in the "Great Moments" series, you will probably be aware of your own reactions to the tapes and also the reactions of your pupils. If you can spare a moment, we would greatly appreciate your jotting down some of these observations. Your comments will prove very valuable to us in evaluating this experimental program.

Name of Tape____ Date Played__________

How did your pupils react to the story? (Include quotations if desired.)

____

____

Which single pupil seemed to show the greatest interest? In what way?

____

____

____

What did you feel was the most effective element in the dramatization? (For example, did you think the narration, the acting, the musical background, or the script itself was outstanding?)

____

____

____

How did your pupils react to the lesson which followed the dramatization?

____

____

____

____

____

____

____

Was the lesson suitable for your pupils in both lesson content and level?

What kinds of learning experiences or activities resulted, directly or indirectly, from the playing of the tape? (Give examples if possible.)

Do you have any suggestions as to how the tape might be made more educative for your class?

THINGS DONE DURING CHRISTMAS VACATION

Name: ______________________________ Date: ____________________

Teacher: ______________________ School: ______________________

INSTRUCTIONS: Below is a list of activities commonly enjoyed by boys and girls during the Christmas season. Read this list and place a check (x) before each activity that you performed during your Christmas vacation. At the end, list any other special activities you enjoyed during the Christmas vacation which has just ended. Check only activities that you did.

___ Selected Christmas tree
___ Helped select Christmas tree
___ Made decorations on the Christmas tree
___ Planned and cared for holiday bouquets, flowers, etc.
___ Made artificial Christmas flowers

___ Identified different kinds of evergreens
___ Decorated windows
___ Suspended food from a tree for the birds
___ Made a bird feeder
___ Observed birds

___ Identified and kept records of birds
___ Identified and kept records of animal tracks
___ Found out where certain animals or birds live
___ Made plaster casts of animal tracks
___ Made a desert garden indoors

___ Looked at and identified stars
___ Grew crystals
___ Balanced an aquarium
___ Designed, made, and sent Christmas greeting cards
___ Designed, made, and sent New Years greeting cards

___ Made a holiday candle
___ Decorated a holiday candle
___ Wrote letters to friends and/or relatives
___ Designed and made gift wrappings
___ Wrapped gifts in new ways or with different kinds of material

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___Looked something up in an encyclopedia or other reference
___Watched a squirrel or other animal play outside
___Went to a zoo
___Made up puzzles (crossword, jigsaw, anagrams, etc.)
___Made shadow pictures

___Tried to figure out how to hold my breath longer
___Made a rocket
___Repaired a bicycle or similar vehicle
___Made something different with an erector set or other construction set
___Made a pinhole camera

___Made up secret messages (codes)
___Wrote with "secret" inks
___Made up a joke
___Traded some of my things with someone else
___Figured out a new skating trick

___Carved things out of soap or wood
___Made a new sled out of cardboard, wood, etc.
___Investigated how some household appliance works
___Trained dog or other pet to do tricks
___Collected and organized stamps or other items

___Mixed colors
___Made a whistle
___Made a firecracker
___Observed wind currents by releasing a balloon
___Signalled with a mirror

___Experimented with making bows and package decorations from ribbon and other materials
___Made a Christmas stocking
___Decorated a Christmas stocking
___Made a gift for someone
___Helped make plans for decorating the outside or inside of the house where you live

___Helped to decorate the inside or outside of the house where you live
___Helped to plan and prepare the Christmas dinner
___Made Christmas candy, popcorn balls, etc.
___Made Christmas cookies or other Christmas food
___Made up and tested an original recipe for food or drink

___Arranged food on a plate or set the table in an interesting way
___Planned and made table decorations
___Helped to plan and make invitations, games, refreshments, or decorations for a party
___Figured out how to improve a game you know
___Figured out how to play a new game

___Played games dealing with words, arithmetic, guessing, maps, or the like
___Made up a puzzle or guessing game
___Made up a new game using equipment you've used in other ways
___Played around with a chemistry set
___Showed a friend how a chemistry set or other object worked

___Took apart a toy, watch, radio, or the like
___Built a tree house or club house outside
___Made a snow man, snow fort, or the like
___Whittled or carved some object
___Embroidered something

___Sewed clothes or other objects for a doll or puppet
___Thought of ways for improving something
___Made designs or model of something you would like to improve
___Carried out plans for improving something
___Thought of inventing something

___Made a model or drawing of your invention
___Wired a doll house or other item electrically
___Took a dry cell apart
___Played with a magnet
___Made puppets

___Made up and carried out a skit or show with puppets
___Made a "microphone"
___Used a magnifying glass, microscope, or telescope
___Began or continued a special notebook or scrapbook
___Wired a doorbell or similar alarm system

___Made something out of clay, such as pottery or figures
___Developed a design for something, such as cloth, jewelry, wallpaper, etc.
___Wove something
___Assembled cards, airplanes, or other things from boys and girls
___Made your own kit from which to assemble things

___Constructed a telephone, telegraph, camera, telescope, motor, electromagnet or radio
___Constructed a musical instrument
___Used a musical instrument
___Made up a new tune or song for your new instrument or one that you already had
___Made up a song to be sung

___Made a scale drawing of your house, room, or some object
___Played with clay, paint, colored pencils, or crayons
___Cut snowflakes from paper
___Designed, made and/or furnished a doll house
___Designed and made paper dolls and/or clothes for them

___Designed and made mechanical man or robot
___Made pictures or other objects from paper
___Took pictures with a camera
___Developed the pictures
___Sketched something you saw (outside or inside)

___Made objects from paper mâche
___Mixed colors
___Made perfume, dye, or ink
___Wrote a poem
___Wrote a story

___Wrote a play
___Acted out play
___Read poem or story to a group
___Kept a diary
___Made up stories, poems, or plays with friends in which each added a part or idea

___Kept a notebook to record ideas to be worked out later
___Wrote a comic strip
___Made a cartoon
___Made up a new dance
___Gave your dance for someone

___Made a map of immediate neighborhood, school grounds, etc.
___Made a map of an imaginary of wished for trip
___Looked at snowflakes to see how they are different
___Went on a trip to a museum, library, or planetarium
___Observed what takes place when water freezes

___Constructed a "movie," puppet theater, television, etc. from boxes or other material
Organized a new club
___Made up magic tricks
___Performed your magic tricks for someone
___Thought of new tricks for dog or other pet

List below any other interesting activities you engaged in during Christmas vacation:

THINGS DONE DURING SUMMER VACATION

Name ________________________________ Boy or Girl ____ Date ________

Teacher in Fourth Grade ________________________________ School ________

INSTRUCTIONS: Below is a list of activities commonly enjoyed by boys and girls during summer vacations. Read this list and place a check (✓) before each activity that you performed during your summer vacation. At the end, list any other special activities you enjoyed during the summer vacation that just ended. Check only activities that you actually did.

___ 1. Listened to sounds of summer such as water lapping on the shore, birds singing, leaves rustling, etc.
___ 2. Told someone about what you hear while listening to summer sounds.
___ 3. Wrote a story or poem about the sounds.
___ 4. Made a drawing or painted a picture about the sounds.
___ 5. Thought of what you would do to make carnival rides more fun.

___ 6. Thought of stories, puzzels or games to make time spent in traveling more fun.
___ 7. Explored a place new to you in your home town or neighborhood.
___ 8. Explored a place new to you somewhere away from your home town.
___ 9. Recorded events on a trip.
___ 10. Made drawings or painted pictures about a summer trip.

___ 11. Thought up plans to celebrate a holiday or special event.
___ 12. Watched a plant or animal grow.
___ 13. Made a record of the growth of something.
___ 14. Arranged an exhibit for a fair or some other purpose.
___ 15. Thought of a money-making project.

___ 16. Gathered materials for the project.
___ 17. Got other people to help you on the project.
___ 18. Advertised your activity with posters or other means.
___ 19. Kept track of your profits and losses.
___ 20. Organized friends and pets for a circus.

___ 21. Persuaded friends to come to your circus.
___ 22. Built a house for your pet.
___ 23. Found good hiding places for items for a treasure hunt.
___ 24. Made up clues for a treasure hunt.
___ 25. Made your own tent from things found around the house and elsewhere.

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____26. Found a good place to pitch your tent.
____27. Swapped things with friends.
____28. Swapped things with a stranger or strangers.
____29. Figured out how to operate some machine or gadget.
____30. Thought of what you would have done differently had you been the player in a baseball game you saw.
____31. Organized sandlot or neighborhood baseball or softball games.
____32. Hunted for items buried long ago.
____33. Collected pictures you like.
____34. Arranged the pictures for others to see.
____35. Wrote letters to friends, relatives, or a pen pal.

____36. Learned a new skill or game:

____Jumping on a pogo stick
____Riding horseback
____Paddling a canoe
____Rowing a boat
____Playing tennis
____Playing badminton
____Playing croquet
____Swimming
____Diving
____Jumping on a trampoline
____Water skiing
____Dominoes
____Checkers
____Chess
____Pool
____Golf
____Skin diving
____Fly casting
____Spearing fish
____Others (please list): ____________________

____37. Improved a skill by figuring out on your own what you have been doing wrong.
____38. Made equipment to use in a sport or game.
____39. Thought of new ways to use your equipment.
____40. Figured out on your own how to play a new game.

41. Made up a new game.
____42. Thought of how to improve a game you already know.
____43. Selected or made gifts for someone.
____44. Designed and made gift wrapping.
____45. Wrapped gifts in new ways or with unusual materials.

46. Decorated packages.
____47. Picked out on your own books to read or records to listen to.
____48. Played with modeling clay, paint, colored pencils, or crayons.
____49. Whittled or carved some object.
____50. Used a wood burning set.

_____51. Made items from wire or metal.
_____52. Made items from leather or plastic strips.
_____53. Made mosaics or other things from paper, seeds, glass, scraps.
_____54. Made pottery.
_____55. Made jewelry.

_____56. Made objects of paper mâche, plaster of paris, sawdust, or cardboard.
_____57. Figured out ways to communicate with a friend in another place by using signals, a code, a homemade telephone or telegraph, or animal messengers.
_____58. Devised a code.
_____59. Sent and/or received messages in invisible ink.
_____60. Trained a tame animal or pet.

_____61. Trained a wild animal.
_____62. Trained a bird.
_____63. Watched ants or other insects.
_____64. Collected insects, butterflies, etc.
_____65. Built an ant house.

_____66. Found a honey tree.
_____67. Watched birds, animals, fish, etc. in their homes out of doors.
_____68. Devised ways of making tree climbing easier by using ropes or steps.
_____69. Built a tree house.
_____70. Blazed a trail with original signals.

_____71. Collected and identified rocks.
_____72. Collected and identified leaves.
_____73. Collected and identified wood samples.
_____74. Collected and identified wild flowers.
_____75. Collected and identified seeds.

_____76. Helped to plan what you need to buy for school.
_____77. Thought up plans to visit some place or someone.
_____78. Took visiting friends or relatives to places of interest.
_____79. Figured out how to pack many things in small places like when you camp, travel, etc.
_____80. Planned a garden.

_____81. Cared for plants.
_____82. Preserved fruits or canned vegetables.
_____83. Made up or experimented with new recipe for a cold drink.
_____84. Made up or experimented with a new recipe for cookies, dessert, etc.
_____85. Arranged and combined vegetables and/or fruits for the table.

_____86. Arranged flowers.
_____87. Made a toy for a younger child.
_____88. Entertained a younger child.
_____89. Found a better fishing or swimming spot.
_____90. Thought of things to do when friends said, "There's nothing to do!"

_____91. Collected maps.
_____92. Collected bottle caps, match covers, napkins, or stamps.
_____93. Organized your collection.
_____94. Made a scrapbook.
_____95. Designed and made a cover for your scrapbook or notebook.

____96. Made a book jacket or cover.
____97. Took pictures.
____98. Developed your pictures.
____99. Organized and arranged your pictures.
____100. Toured a factory, office, art center, museum, zoo, etc.

____101. Went to a planetarium.
____102. Collected materials for an experiment.
____103. Experimented to test out an idea.
____104. Thought of new uses for familiar objects.
____105. Helped someone improve what they are doing.

____106. Originated and wrote a newspaper, magazine, or advertisements.
____107. Duplicated and distributed a newspaper, magazine, or advertisements.
____108. Made birthday cards or greeting cards for a special event.
____109. Made diagrams of something.
____110. Looked for frogs, turtles, snakes, water bugs, etc.

____111. Figured out how to catch a squirrel, chipmunk, or other wild animal.
____112. Made diagrams of something.
____113. Made charts or graphs of something.
____114. Thought of new ways to ride a bike or scooter.
____115. Collected autographs or baseball cards.

____116. Made up a new club.
____117. Made up rules for the club.
____118. Found a place for your club to meet.
____119. Built a club house.
____120. Planned some big activity for your club.

____121. Put up a rope swing.
____122. Did tricks on a rope swing bar.
____123. Went for walks.
____124. Explored a cave.
____125. Followed a river or river bank.

____126. Planned and took bike hikes.
____127. Taught pets tricks.
____128. Found better routes to often visited places.
____129. Made your own bow and arrows.
____130. Made artificial flowers.

____131. Made a bird feeder or bird bath.
____132. Watched bird or animal make a nest.
____133. Identified and kept records on bird or animal tracks.
____134. Made plaster casts of tracks of animals or birds.
____135. Made a desert garden.

____136. Balanced a field or commercial aquarium.
____137. Looked at and identified stars.
____138. Grew crystals.
____139. Made a candle.
____140. Decorated the candle.

____141. Made up puzzles (crossword, jigsaw, anagrams, etc.)
____142. Made shadow pictures.
____143. Tried to figure out how to hold my breath longer.
____144. Made a rocket.
____145. Repaired a bicycle or similar vehicle.

____146. Made something different with an erector set or other construction.
____147. Made a pinhole camera.
____148. Made up a joke.
____149. Figured out a new trick.
____150. Found out how some household appliance works.

____151. Mixed colors or otherwise experimented with colors.
____152. Made a whistle.
____153. Made a firecracker.
____154. Observed wind currents by releasing a balloon.
____155. Signaled with a mirror.

____156. Helped make plans for decorating the house for a special occasion.
____157. Helped improve the outside or inside of your house.
____158. Helped to plan and prepare a cookout, picnic, or special meal.
____159. Make snacks like ice cream or popsicle.
____160. Shopped alone for groceries.

____161. Froze items in ice cubes to make cold drinks more interesting.
____162. Planned and made invitations for a party.
____163. Planned and made up games for a party.
____164. Planned and made decorations for a party.
____165. Planned and made refreshments for a party.

____166. Played games dealing with words, guessing names, etc.
____167. Played games dealing with numbers, arithmetic, etc.
____168. Played games dealing with maps, etc.
____169. Made a map of some place where you visited.
____170. Made up a guessing game.

____171. Played around with a chemistry set, biology set, etc.
____172. Showed somebody something you discovered with a chemistry set.
____173. Took apart a toy, watch, radio, etc.
____174. Embroidered, knit, or wove some object.
____175. Designed clothes for a person or doll.

____176. Made up a pattern for the clothes.
____177. Helped select a pattern or material for an item to be sewn.
____178. Sewed clothes or other objects for a person, puppet, etc.
____179. Made costumes for yourself or others.
____180. Made designs or a model of something you dreamed up or want to improve.

____181. Carried out plans for improving something.
____182. Thought of inventing something.
____183. Made a drawing or model for your invention.
____184. Wired a play house, doll house, dog house, or other item electrically.
____185. Designed, made, and furnished a toy house.

____186. Took a dry cell apart.
____187. Played with a magnet.
____188. Made puppets.
____189. Made a puppet theater.
____190. Made up and carried out a skit or show with puppets.

____191. Made a "microphone" and produced a radio or TV show.
____192. Used a magnifying glass, microscope, or telescope.
____193. Began or continued a special notebook.
____194. Wired a doorbell or similar alarm system.
____195. Developed a design for cloth, jewelry, etc.

____196. Assembled cars, airplanes, or other objects from kits.
____197. Made your own kit from which to assemble things.
____198. Made things using wood and tools.
____199. Figured out how a musical instrument works.
____200. Made up a new tune or song for an instrument.

____201. Made up a song to be sung.
____202. Planned a room arrangement to better suit you and your family.
____203. Designed and made a mechanical man or robot.
____204. Made pictures or other objects from paper or cardboard.
____205. Made perfume, dye, ink, etc.

____206. Wrote a play.
____207. Acted out a play.
____208. Read your story or poem to a group.
____209. Made up stories to entertain others.
____210. Kept a diary or log book.

____211. Kept a notebook or record of ideas to be worked out later.
____212. Wrote a comic strip.
____213. Made a cartoon.
____214. Made up a new dance.
____215. Performed your dance for someone.

____216. Made a map of your neighborhood.
____217. Made a map or an imaginary or wished for trip.
____218. Observed ice melting.
____219. Noticed droplets or water on the outside of a glass of cold contents.
____220. Examined a bird or flying insect and tried to figure out what makes them fly.

____221. Made a television or movie from boxes.
____222. Made up or performed magic tricks.
____223. Learned to mimic some animal sound.
____224. Learned to mimic some bird song.
____225. Studied or read about some subject on your own.

____226. ______________________________
____227. ______________________________
____228. ______________________________
____229. ______________________________
____230. ______________________________

TEACHER EVALUATIONS OF CREATIVITY

Teacher______________________________Grade__________

School______________________________Date__________

1. Which children in your class are the most fluent in the production of ideas? These are children who seem to be "just running over with ideas," though not always the most talkative. Some of their ideas may not be of high quality.

(1)______________________________

(2)______________________________

(3)______________________________

(4)______________________________

(5)______________________________

Which are the least fluent?

(1)______________________________

(2)______________________________

(3)______________________________

(4)______________________________

(5)______________________________

2. Which children in your class are the most flexibile in their thinking and in the production of ideas? When one plan or procedure fails, they come up immediately with a different approach. They employ a variety of strategies or approaches in solving problems. They readily abandon unproductive approaches although they do not abandon the goal; they simply find some other way of achieving the goal.

(1)______________________________

(2)______________________________

(3)______________________________

(4)______________________________

(5)______________________________

Which are the least flexible?

(1)______________________________

(2)______________________________

(3)______________________________

(4)______________________________

(5)______________________________

3. Which children in your class are the most original in their thinking? They are able to get away from the obvious and the commonplace and break away from the beaten path. They see relationships and think of ideas and solutions which are different from others in the class and from the textbook. Many, though not all, of their ideas prove to be useful. Some of their ideas are quite surprising, though true.

(1)
(2)
(3)
(4)
(5)

Which are the least original?

(1)
(2)
(3)
(4)
(5)

4. Which children in your class are the best in elaborating ideas? They are able to take an idea or a task and spell out the detail. They can take a simple idea and "embroider" it or make it fancy and attractive. Their drawings are very detailed and they are able to develop very detailed or thorough plans for projects.

(1)
(2)
(3)
(4)
(5)

Which are least able to elaborate?

(1)
(2)
(3)
(4)
(5)

YOUR ORIENTATION GUIDE

to

PROGRAMMED EXPERIENCES IN CREATIVE THINKING
(An Audio Teaching Aid Designed to Motivate
and Guide Creative Behavior Among Fourth Graders)

By Bert F. Cunnington and E. Paul Torrance

BUREAU OF EDUCATIONAL RESEARCH
University of Minnesota
September 1962

PROGRAMMED EXPERIENCES IN CREATIVE THINKING

An Audio Teaching Aid Designed to Motivate and Guide Creative Behavior Among Fourth Graders

WHAT: "Programmed Experiences in Creative Thinking" relate to a set of 16 dramatic audio tapes being produced for fourth-grade experimental use.

WHY: These recordings and related materials are intended to help avoid the so-called "fourth-grade slump" in creative thinking. They will have five major objectives:

1. to discover, motivate and develop creative awareness
2. to produce an understanding of the nature and value of creative thinking
3. to provide a dramatized supplement to the curriculum in the fields of science, history, geography, and language arts
4. to stimulate and guide creative behavior
5. to create an awareness of the value of one's own ideas

The bulk of the dramatized material will correlate with the curriculum of most fourth grades. Accordingly, 25 per cent of the tapes will deal with great moments of scientific discovery and invention, 25 per cent with historical achievements, and 25 per cent with the relationship of man to his environment. The remaining 25 per cent will deal with pure fantasy, mostly related to language arts.

WHO: This project is being financed largely by a grant from the U. S. Office of Education under the auspices of Title VII, under the National Defense Act of 1958 to develop new educational media. It is being produced by the Bureau of Educational Research. The materials are being created and produced by B. F. Cunnington under the direction of Dr. E. Paul Torrance and with the assistance of Mr. Richard Peterson, Mrs. Pearl Buckland, Mr. R. E. Myers and others.

WHEN: This is a two-year project. The first year has been devoted to research into sources, writing, production and experimental testing of the materials. The second year will be devoted to the completion cf the materials and formal testing of their effects. Should the experimental program prove successful, the taped series will be considered for publication.

WHERE: The recordings, teachers' manuals and related materials will have their major test in the fourth-grade classes of the Richfield Public School System. Tests will also be made in classes in Minneapolis, Minnesota; Sioux Falls, South Dakota; Brunswick, Georgia; and Greenville, South Carolina.

INTRODUCTION

For many years, educators and other observers have noted declines both in the measured "creativity" and in creative behaviors of almost all kinds at the fourth grade. During the past five years, the University of Minnesota Bureau of Educational Research has rather thoroughly documented this decline (Torrance, 1962).

Many possible reasons have been advanced to explain this so-called "creativity dip," and a number of studies have been undertaken to discover means by which this decline can be prevented or checked. This brochure relates to one of these studies -- specifically, programmed experiences in creative thinking -- a project designed to provide materials which can be used creatively by teachers in developing the creative talents of fourth grade pupils. In the creation of these materials, a deliberate attempt has been made to build into them the findings and insights provided by some thirty separate experiments conducted by the Bureau of Educational Research and the sum total of the research which has accumulated from other sources.

These programmed experiences also represent an attempt to prevent or at least reduce failures due to the inhibiting attitudes, lack of spontaneity and lack of time of elementary teachers. Insofar as possible, an attempt has been made to create through the taped materials many of the conditions which we know are necessary for the operation of the creative thinking processes.

Like other aids to creativity, these programmed experiences are intended to discover, encourage, and develop a creative awareness -- greater aliveness -- and creative activity. Unlike others, however, they employ the means of a fairly new educational medium -- audio tape. Whereas conventional teaching aids involve the use of workbooks and other visual materials, this method makes use of the excitement, imagination and drama inherent within the broad medium of sound.

How This Experimental Program Began

It was in the summer of 1960 that an attempt was first made to apply this particular technique to classroom use. An effective (if somewhat crude) dramatic audio tape was produced that summer, and subsequently implemented as a motivational tool for an art education summer session class directed by Dr. Clifton Gayne, Chairman of the University of Minnesota Art Education Department. So successful were the results of this experiment that further development was undertaken from January through June of 1961, a period which saw the formulation of the plan for the present program.

Pilot Studies

The pilot experiences involved the preparation of three audio tapes, together with several different integrated lesson units. These tapes were field-tested from February through May of 1961 in twelve different classroom situations in Richfield, Minneapolis, and St. Louis Park. Some five hundred fourth, fifth, and sixth grade children participated in these tryouts. (The majority of these tests centered at Centennial School, Richfield, in two fourth-grade, two fifth-grade, and two sixth-grade rooms.) Further testing was accomplished at the University of Minnesota Elementary School and the Tuttle School, both in Minneapolis, during the months of May and June, 1961.

THE RECORDED DRAMAS

Just what are "Programmed Experiences in Creative Thinking"? How do you, the teacher fit in? To answer these questions, let us begin by discussing first the recorded dramas themselves. As already indicated, these 16 separate productions fall into four divisions: Science, History, Geography, and Fantasy. The Science stories involve such notables as the Wright Brothers, Robert Goddard, Thomas Edison, and Alexander Graham Bell. The History series, meanwhile features such personalities as Benjamin Franklin, Louis Braille, Henry Ford, and Samuel F. B. Morse. Men like Lewis and Clark and Rear Admiral Byrd are featured in the Geography section. Every effort has been made to make all of these dramas as authentic as possible. Finally, under the Fantasy heading, we present such fanciful tales as "The Dog They Named King" and "Giovanni and the Giant".

Each of the 16 tapes revolve about the role of creative problem-solving, the importance of courage, and other characteristics necessary for creative achievement. Hence, you and your class will gain intimate insights into the thought processes which enabled courageous men like Edison, Bell, and the Wright Brothers to solve their particular problems while engrossed in the development of such diverse inventions as the electric light, the telephone and the airplane. You and your class will "see," first hand, how such explorers as Lewis and Clark and Richard Byrd applied courage and the creative process in the out-of-doors to unlock some of the world's deepest geographical secrets through their ventures into the unknown. You and your class will be entertained -- and educated -- while you learn together how a young, cowardly woodcutter conquers a towering giant by using his creative, imaginative powers and some newly-found bravery...and how a courageous pet dog stumbles upon the problem-solving concept by sheer accident and thus saves his loved ones from the machinations of a wicked witch. An effort is being made to recreate, for the History and Science series, some of the truly significant inventions and discoveries of the past 200 years.

Some of the productions within the Geography and Fantasy series present an opportunity to employ the "stop-tape" device, whereby the teacher may shut off the machine at one or more climatic moments and then request the class to provide solutions to the problem being encountered. After the class has responded, the story may proceed to the conclusion, thus allowing the subjects to compare their responses within the recorded solutions, as one "reward". Some of the solutions by pupils, however, may be more clever or effective than the recorded solution. This, too, should be rewarding.

The Great Moments of Discovery series has been included to acquaint boys and girls with the nature of the creative process and the value of original ideas, and to stimulate original thinking among pupils. The inclusion of the Fantasy materials is based on the rationale that fantasy needs to be kept alive in children until their intellectual development is such that they can engage in sound types of creativity requiring the careful testing and modification of ideas. Its inclusion represents an attempt to offset, to some extent, an excessive quest for certainty, safety, objectivity and the like so common among fourth graders.

BACKGROUNDING THE PRODUCTIONS

While presenting over a period of about eight months these 16 tapes for your class, you will find that each of them is presented dramatically (with appropriate sound and musical effects) by a disciplined group of actors, narrators and other talent.

In producing these recordings, much care is being taken to document the Science, History, and Geography tapes with fidelity to historical fact. As much as possible, primary sources have been consulted for accuracy. Among them have been accounts written specifically for children. These particular materials have been studied for ideas relating to the transmission of complex and advanced concepts written in terms which can be grasped and used by children. The Fantasy series, meanwhile, is being produced with great attention to source materials from other ages and lands... use of particularly imaginative sound and musical effects...and the talent selected to portray the various and colorful characters involved in the stories.

Real effort is being made to tailor the entire series, as closely as possible, to the level of the fourth-grade pupil without "talking down" to him. Hence, an effort is being made to make the research as exhaustive and thorough as possible. Vocabulary level and sentence structure is being supervised closely by a group of consultants with considerable experience in teaching fourth-grade classes.

Creator and producer of the series is B. F. Cunnington, a former freelance writer who holds his B.A. degree in journalism and radio speech from the University of Minnesota.

Principal script consultant is Betty Girling, Director of the Minnesota School of the Air at the University of Minnesota.

Much of the documentary research has been done by Richard Peterson, a former elementary and secondary teacher and now a graduate student in Special Education. R. E. Myers, a former fourth-grade teacher and author of numerous articles and curricular materials for creative classroom activities and now instructor in elementary education at Augsburg College, has been the principal consultant on the lessons which accompany the tapes. Mrs. Pearl Buckland, a former fourth-grade teacher and a graduate student in elementary education, is preparing most of the manuals and has also contributed many ideas for the lessons.

Actual production is being accomplished at Educational Materials Center (EMC) Recording Corporation, St. Paul, producer of the audio-tape series in Spanish used in Richfield's fourth-grade classes during the 1960-61 school year. EMC is also producer of tape supplements for the language programs of many of the nation's largest publishers of educational textbooks.

After some rather careful surveys of possible curricular content and of fourth-grade curricula, a questionnaire was used to determine the final selections of curricular content. A questionnaire was mailed to elementary educators across the country. Respondents were asked to select from a large list of possible titles and synopses those which best reflected the fourth-grade curriculum of his particular school system. It is felt that the titles thus chosen for development reflect, in the main, a general cross-section of national educational opinion. It is felt further that these titles will offer interesting and dramatic supplements to your present curriculum, in addition to providing real springboards to imaginative and creative activity. It should be pointed out, however, that the tapes introduce many concepts too new to be ordinarily contained in elementary school curricula. Others are concepts which are usually reserved for advanced students but can be grasped by fourth-grade pupils and, we believe, become powerful tools in their thinking.

CLASSROOM APPLICATIONS

But how are these recorded adventures to be applied in the classroom? How are the dramatized exploits of diverse, creative problem-solving like

Braille, Bell, and Ben Franklin to be transformed into creative experiences for your fourth-graders?

Classroom applications may be achieved by some combination of the following four approaches:

1. By means of pre-recorded, spoken lessons (which may precede, follow, or come in the middle of the drama itself) designed to direct the class to creative activity . . .
2. By means of some of the alternative lessons suggested in the manuals which accompany each tape and provide the teacher with much optional supplementary material . . .
3. By means of lessons conceived by the teacher and/or the pupils . . .
4. By means of "follow-up" activities either detailed or suggested in an accompanying manual and thought of by the pupils themselves either as individual or group projects.

Each tape box will disply a label containing information about the contents of the reel. This information will consist of two elements: the title of the dramatized production...and the title(s) of the integrated recorded lesson(s). Accompanying these data will be information relative to tape speed and timings. Thus, a typical label might look like this:

1) "Trailblazer to the Stars"
(The Robert Goddard Story)
3.75 ips. 21:00
2) Lesson: "Finish the Story"
3.75 ips. 5:00

THE ACCOMPANYING MANUALS

The manuals accompanying each tape are designed to guide you, the teacher, in making the best possible use of the recorded materials. Each manual will follow a coordinated outline:

Possible Outcomes, relating to a specific set of basic values drawn from the drama, and later stressed in the accompanying lesson(s).

Readiness For Listening, wherein are discussed such items as plot, vocabulary, geographical locations, time elements and the like.

Interpreting the Tape, wherein are discussed such matters as story elements, implications and extensions of ideas, and suggestions for both individual and group activities.

A supplementary manual will also accompany each lesson, as will a script of the spoken lesson itself. A script for each recorded drama will be included, also.

OBJECTIVES OF THE PROJECT

This project's main objectives will be to determine how effectively the audio tape series will contribute toward the prevention or reduction of the so-called "fourth-grade slump" in creative thinking -- and thus result in greater creative growth and excitement about learning, without sacrificing traditional kinds of achievement.

To measure this growth, a battery of achievement tests will be administered to all fourth-grade classes participating in the evaluation. The testing battery will be administered both at the beginning of the school term and at its end.

The participating classes will be assigned sometime in eary September, either as experimental or control groups. It is hypothesized that the experimental group (those using the tapes) will show greater growth at the conclusion of the experiment than will the control group (those not using the tapes) -- that they will show greater creative growth and excitement about learning than will the controls without any sacrifice of traditional kinds of achievement in reading, arithmetic and the like.

SAMPLING PROCEDURES

The experimental group will be provided with the tapes and the accompanying manuals, which will delineate the day-by-day procedure to be followed. The control group, meanwhile, will be provided with none of the above materials. Control classes will be drawn from the same schools as the experimental classes. All of the controls will operate under conditions of heterogeneous grouping. All reasonable efforts will be made to assure that the composition of the controls and the experimentals are similar in size, ability level, racial and socio-economic characteristics, and the like.

PRE- AND POST-TESTING PROCEDURES

Prior to the introduction of and at the conclusion of the experimental program, a battery of standardized achievement tests, a battery of creative thinking tasks, and Hoyt's "How I Like School" inventory will be administered to all subjects. Records will also be kept of the creative activities and achievements of the subjects during the course of the experiment. The achievements battery to be used will probably be the Iowa Tests of Basic Skills (vocabulary, reading, language, work-study skills, and arithmetic).

A battery of two verbal and two non-verbal tasks has been assembled for use in this study. These particular tasks have already been administered to several thousand subjects of varying ages, cultures, types of schools and the like. Creative growth will also be assessed through imaginative stories written by the subjects. Also to be included in the creative thinking battery will be the Sound Effect Tests of Original Thinking (Cunnington and Torrance, 1962), wherein the subjects are directed via pre-recorded instructions to respond in different ways to a group of mysterious and stimulating sounds.

The measure of enjoyment of school and excitement about learning will be the "How I Like School" inventory developed by Cyril J. Hoyt, consisting of 50 items. Check-lists of creative activities relating to the language arts, science, social studies, art, music and the like will be used to obtain a measure of the extent to which pupils engage in creative thinking activities on their own.

CLASSROOM PROCEDURE AND SCHEDULING OF THE TAPE PROGRAM

In order to obtain optimum value from this audio tape series, the producers urge that, as far as possible, a new tape be introduced to the class EVERY OTHER WEEK. It is felt that this twice-per-month schedule will provide maximum stimulus reinforcement with minimum interest-drop as the series progresses.

Since most of the dramas in the series are separate from the lessons (that is to say they either procede or follow the dramas themselves), we suggest that, IF AT ALL POSSIBLE, you divide the listening session into two periods extending over TWO SUCCESSIVE DAYS. This procedure should help to sustain the interest of the class by maintaining stimulus over shorter listening periods. It will help also to check possible flagging of interest induced by excessively long listening sessions.

The following is a suggested sample schedule you might with to follow:

MONDAY: 1. Prepare the class for the listening session
2. Play the taped drama
3. Discuss the story

TUESDAY: 1. Review and conclude discussion of Monday's activities
2. Prepare the class for the lesson period
3. Play the lesson...or present one of your own
4. Guide follow-up activity

In some instances, two lessons will accompany a single drama. In cases where the lessons are split, so that one lesson precedes while the other follows the drama, a Monday-Tuesday-Wednesday (or three-successive-day) schedule is recommended. Where both lessons follow the drama, you might wish to either run both lessons on the same day or on successive days, depending on your own schedule. Only in rare cases will we suggest carrying the second lesson over to the third day. You and your pupils, however, might want to follow through with learning and thinking activities which flow naturally from these experiences.

YOU PLAY THE MOST IMPORTANT PART!

In conclusion, let us emphasize that "Programmed Experiences in Creative Thinking" are not intended as ends in themselves, but rather, the means to those ends: the stimulation of new ideas...the exploration of new vistas of the imagination...and the development of new viewpoints on man and the world in which he lives.

Hence, you will find these programmed experiences helpful not only as instructional tools, but useful too as "jumping-off places" from which you and your class may explore together the new horizons we hope they will open to you.

Just remember -- this is an OPEN-ENDED series. The tapes and the manuals can suggest only so much, can accomplish only so much. Beyond this point, it's up to YOU to take it from there. Once the dramas have been played and the lessons have been utilized, it's YOUR job to tailor to the needs of your individual class whatever follow-up activities you may wish to pursue... in your own individual way. In other words, let your own creativity operate in using these materials!

The tapes can motivate, true enough. And the manuals can guide. But in the final analysis, the success or failure of the entire experiment falls squarely on your shoulders. For this series does NOT constitute a teaching-machine situation, wherein the teacher's function is, at best, a limited one. Rather, it is a program whose ultimate value will depend upon the depth of your personal involvement with it, and upon the depth to which that involvement guides BOTH you and your class toward the goal of more creative expression, for today and tomorrow.

"EYES AT THEIR FINGERTIPS"

The Story of Louis Braille

Script and Production by Bert F. Cunnington

Teacher's Manual by Pearl Buckland

Suggested Readings and Documentation by Richard Peterson

Cover Design by Elizabeth Kennedy

BUREAU OF EDUCATIONAL RESEARCH

College of Education, University of Minnesota

September 1962

FOREWORD

Fourth grade pupils should find an especial appeal in "Eyes at Their Fingertips," because its hero, Louis Braille, was about their age when he started working on the idea of a better type of writing for the blind. Furthermore, he had worked out his system rather thoroughly and had tested it by the time he was 15. This should help communicate to fourth graders that their ideas are important and that it will be they who will find the solutions to many of the problems which man has not yet been able to solve.

This story, too, illustrates the need for courage, sacrifice, persistence, and imagination. It illustrates the necessity for working out the details of an idea before it can be made useful and gain acceptance. It also describes some of the typical difficulties involved in gaining acceptance for new ideas. Even though Braille's system had been tested and demonstrated to be successful, it was 43 years after his death before general acceptance was gained. The training schools resisted accepting it because the teachers would have to learn a new system. The textbook publishers fought its acceptance because it would mean the end of the remmnerative, if ungainly, embossed books.

The tape, manual, and related materials were developed with the aid of funds from the U.S. Office of Education under Title VII of the National Defense Act of 1958.

E. Paul Torrance, Director
Bureau of Educational Research

Bert F. Cunnington
Production Coordinator

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THE DRAMA

POSSIBLE OUTCOMES

- To understand that inventions are created by individuals sensitive to their own needs and to those of others.
- To realize that solutions to problems may be arrived at gradually through:
  1) a period of utilizing past experiences and the knowledge of others;
  2) a creative period in which experiences are reorganized into something new.
- To see the need for working out full implications of ideas.
- To value self-initiated projects.
- To become more tolerant of new ideas and of those who produce them.
- To recognize that the ideas of boys and girls may be quite valuable.

READINESS FOR LISTENING

Story Features

Plot. Early in the Nineteenth Century, blind but tenacious Louis Braille at fifteen developed an alphabet for the blind which gave them "eyes at their fingertips".

Vocabulary. You may wish to familiarize the pupils with the following words: embossed, invention, stylus, phonetic system, symbols, codes, international, and demonstration.

Geographical locations. Louis Braille was born in 1809 into the family of a harness-maker who lived in the little village of Coupvray near Paris, France. He went to school at the National Institute for Blind Youth in Paris. In 1878, twenty-six years following his death, Braille's invention was made the official, international system of writing for the blind.

Time elements. Because this story follows a simple chronological order, you may wish only to tell your pupils that Louis Braille was born about 150 years ago at a time when little help other than charity was extended to the blind. The fact that Braille independently developed a useful alphabet for the blind by the time he was only 15 years of age, and that he became interested in solving the problem when he was about 10 may be important points of emphasis.

Regarding the Creative Process

At home, in school, and in the community. To help the child realize that inventions are created by individuals sensitive to themselves and to their environment, you might ask questions such as: "What inventions or conveniences help you, your friends or your family do things easier, more quickly or in a way that is more fun? How do you suppose the person got the idea for inventing______________________________?

"What things at home or in school 'bother' you or 'get under your skin?' What could you invent that would make the task more fun, or easier?"

Resistance to new inventions could be brought out at this point. Many a grandfather, alive today, as a young man thought that cars surely were the work of the Devil himself.

You might correlate the pupils' present activities and reading experiences with the present lesson in pointing out the need for working out full implications of ideas. Many basal readers and social studies textbooks deal with this theme. It might be fun to speculate as to what might have happened if Columbus had decided to turn around in mid-ocean or if Edison had stopped experimenting when one filament after another turned to ash.

In the adult world. Technological innovations have changed the work and play habits of fathers, mothers, brothers, and aunts. You might also wish to call attention to current space and communication exploration.

Purposes for Listening

The listeners might find it helpful to have the following questions before them on a prepared sheet on which they can take notes as they listen. (All points are clearly emphasized on the tape in the order given.)

The pupils might listen to find out:

1) Why did young Louis Braille develop his special alphabet?
2) What ideas and experiences did he use?
3) What ideas did he develop which were his alone?
4) What did others think about his new alphabet? Why?
5) How did this new alphabet change the lives of blind people?

INTERPRETING THE TAPE

Story Elements

Sometimes it is effective to allow pupils to break up into small groups to discuss specific points with the purpose of bringing "big ideas" to the whole group discussion which would follow. The pupils could then use their notes and questions. Perhaps additional questions could be raised and reacted to.

Implications and Extensions of Ideas

If there is a sight-saving class in your school or system, you might invite the teacher to talk to the class. Perhaps it would be more expedient to allow one or a group of your pupils to interview her using questions raised by the children and with the purpose of sharing the information they gathered with the class.

Encyclopedias give examples of the Braille alphabet which you might like to show or put on the board.

You might like to discuss ideas such as: "How is the life of a blind person different in 1962 because Louise Braille lived? Why didn't publishers immediately accept Braille's idea even though it was more beneficial to the blind than older methods? How do you suppose he felt in the years when he was just beginning to work out his idea? Why do you suppose he kept on working though he became tired and ill?"

Often creative and/or highly channeled individuals are not well-liked because they don't do things as the majority does. Pupils need to develop tolerance and acceptance for new ideas and for the people who produce them. Perhaps highly creative pupils need to be helped to be less obnoxious. To extend these ideas you might ask, "Would you have liked the boy Braille? Why or why not? How is Braille like others you've read about or heard about?"

"If you could create any kind of an invention to help yourself or others, what would it be? How would you go about working out your idea?"

CREATIVE ACTIVITIES

Activities Which Could be Done by the Individual

- Engaging in re-creative activities such as investigating, using, and improving the Morse Code or the Boy Scout Code.
- Creating a new code and putting it on a mimeographed sheet for others to puzzle over.
- Proposing an invention, writing about it, diagramming it, or making a model of it.
- Investigating topics of interest such as: Famous Blind Men and Women, Ways Our School Helps the Blind, France in the 1800's.

Activities Which Could be Done by the Whole Group

- Tracing the development of an invention of interest to individuals or a small group.
- Creatively dramatizing moments of discovery.

- Making a booklet, mural, or movie concerned with real or imaginary inventions.
- Participating in a free "brainstorming" period in which to play around with ideas such as "Why don't they invent...?" or "I wish they'd invent...." in which ideas could be expressed by writing, drawing, or in any chosen manner.

CODE LESSON TO FOLLOW EYES AT THEIR FINGERTIPS

POSSIBLE OUTCOMES

- To enjoy working out full implications of one's idea
- To value and utilize contributions of others
- To grow in understanding of how people communicate with each other

MATERIALS NEEDED

The children should have paper and pencil on their desk and an alphabet before them.

READINESS FOR LISTENING

The taped lesson. The announcer gives clues to help the children "crack" a code in which "A" is 26 and "Z" is 1.

Vocabulary. You may wish to familiarize the children with the following words: Morse Code, a system of dots, dashes, and spaces used in telegraph; and semaphore, a system of signaling by using flags.

The creative process. Because the taped lesson is designed to serve as a warm up activity to stimulate creative thinking, you may wish to delay discussion until after the children have heard the taped lesson.

Purposes for listening. You might tell the children they will be given a clue to a code and then a message written in that code. They should listen to "crack" the code and to figure out the five-word message.

INTERPRETING THE TAPE

The Code

The code used in the taped lesson is as follows:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

The five-word message in the recorded lesson -- decoded of course -- is, "Make up your own code."

The children might like to pair off to propose and decode messages for one another using the code in the lesson.

An easier code. If you notice a small group of pupils who do not seem to understand the code as given in the taped lesson, you might take them aside while the others are working in pairs to allow them to work out this simpler code:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Q	R	S	T	U	V	W	X	Y	Z
17	18	19	20	21	22	23	24	25	26

Here are two clues for the simpler code:

Clue I

"Z" is 26 and "A" is 1;
Break this code and have some fun!

Clue II

"B" is two and "D" is four;
Once you catch on, you're ready for more!

Here is a message in the easier code:

First word:	3-15-4-5-19
Second word:	1-18-5
Third word:	6-21-14

Decoded the message reads, "Codes are fun."

A more difficult code. You may wish to use the following code with a small group or with the whole group after they have had experiences working in pairs with the code as given in the taped lesson:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10

The children will need to use both clues because the first clue does not narrow the possibilities further enough.

Clue I

A letter that rhymes with "few"
Is the place where you'll find your first clue;
The numbers start here
And proceed to the rear,
Then continue with "A" right on through!

Clue II

The letter that starts the word "quick"
Is your tip-off to this decoding trick;
The letter rhymes with "glue,"
With "new" and "canoe;"
Use it to make your code click!

The message "Coding and decoding can be fun" written in code looks like this:

First word: 13-25-14-19-24-17
Second word: 11-24-14
Third word: 14-15-13-25-14-19-24-17
Fourth word: 13-11-24
Fifth word: 12-15
Sixth word: 16-5-24

Implications and Extensions of Ideas

After the children are "warmed up" to the idea, give them time for thinking and working out original codes of their own invention which they could share with others at a specified time and place. Perhaps you could set aside a bulletin board on which children could post clues to a code and messages written in the code on 4" by 6" cards. The child originating the code could put the answer on the back of the card so that the person who "cracks" the code would be immediately rewarded.

If no bulletin board space is available, you might supply the children with a box in which they could put their clue-and-message cards. Many children like to put their clues and coded messages on a sheet to be dittoed for their classmates. Perhaps some kind of arrangement could be worked out with another fourth grade in which sheets and cards could be shared. You could hold a contest in which the children would have a chance to "crack" the codes which prove to be the most challenging.

Sometimes during the duration of the coding adventure you might like to discuss ways in which facial gestures, mannerisms, habits, prejudices, expectations, and attitudes influence daily communication. Individuals constantly send messages of which they are unaware. but which are "received" and "decoded". Perhaps children need to be helped to become aware of difficulties inherent in "sending" and "receiving" verbal and written messages.

CREATIVE ACTIVITIES

Activities Which Could be Done by the Individual

- Investigating such topics as: "Fish Talk," "Animal Signals," "Sounds from the Stars," and "Communicating Through the Ages"
- Working out additional codes utilizing symbols other than numbers
- Making codes in which individual letters within words are discovered by working arithmetic problems

- **Visiting the Science Institute in St. Paul to see examples of communication systems and instruments of ancient times and differing cultures**

Activities Which Could be Done by the Group

- **Making a booklet of favorite original codes and signal systems**
- **Planning and making construction paper flags to use for signals**
- **Planning and constructing a signal system whereby daily weather information could be shared**
- **Sharing books concerned with methods of communication**
- **Discussing factors important to effective communication**

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"EYES AT THEIR FINGERTIPS"
The Story of Louis Braille

An Imagi/Craft Production
For Fourth Grade Use . . .

MUSIC: IMAGI/CRAFT THEME

NARR.: Imagi/Craft Productions presents the story of Louis Braille, and how he pioneered to give to the blind the power to see with "Eyes At Their Fingertips."

MUSIC: FADE OUT

SOUND: FADE IN STREET NOISES --- PERIOD TRAFFIC, CIRCA 1800

VOICE: Pennies for the blind . . . Pennies for the blind . . . Who will give a few coins to a poor blind man? Pennies for the blind . . .

SOUND: CLINK OF COINS INTO METAL CUP

Thank you, my kind friend; thank you! May the good Lord bless you! . . . Pennies for the blind . . . (FADE) . . . Pennies for the blind . . .

SOUND: FADE OUT SOUND BENEATH FOLLOWING NARRATION

NARR.: This is the voice of a blind beggar, walking the streets of Paris, France --- the Paris of 1800, well over a hundred and fifty years ago. In those days, to earn a living was difficult enough even for those who could see. But for the blind, the daily struggle for food and shelter was almost impossible.

MUSIC: SLIP IN DOCUMENTARY UNDERSCORE

From the beginning of man's history, the blind had always been among the unwanted. In pre-historic times, they were simply put to death, along with the crippled and the sick. Finally, many centuries later, they were at last granted the right to live. But even then, they still had little to live for. There were a few lucky ones -- a handful of intelligent, talented, or wealthy blind men scattered here and there through the pages of history.

These sightless yet fortunate ones could live with dignity. But they were very rare, numbering less than perhaps one in ten thousand. For the rest of the sightless, the only possible way for them to earn a living was by begging for money and food. These people found the world a hard one indeed -- a world of darkness and despair.

But at the beginning of the 19th Century, an event occurred which was soon to change forever the face of that world. On January 4, 1809, a son was born to the family of a simple harness-maker, who lived in the little French village of Coupvray, not far from the great city of Paris. He was christened Louis Braille.

For three years Louis lived the life of a happy youngster. Then one day in the late winter of 1812, he suffered a serious accident while playing with a knife, which blinded his left eye.

MUSIC: OUT

Infection soon set in, and within days he lost the sight of the other eye, also. However, Louis Braille was an unusually courageous and gay-spirited child, and soon he learned to live with his blindness.

When he was seven, he was enrolled in the village school -- a school for sighted children. But life here was very difficult for Louis, since the school could not properly educate those who could not see. The three years he spent here were very unhappy ones, indeed.

Then, one day in 1818, the village priest visited Louis' father. He was fairly bubbling over with exciting news of a school he had seen on a recent trip to Paris -- a school especially for blind children.

PRIEST: I tell you, M'sieu Braille -- this school -- the National Institute for Blind Youth -- it is a WONDERFUL place ! It was founded to give blind children like your little Louis a REAL education, and to train them to lead really USEFUL lives. Would you believe it -- I saw little blind boys being taught to play the piano and the pipe organ and the violin! I saw them being taught to make their own clothes and their own shoes! I even saw them being taught to read and write. But BEST OF ALL, they were such HAPPY children! M'sieu Braille, I beg of you -- send little Louis there. Give him a REAL chance in life!

MUSIC: APPROPRIATE BRIDGE

NARR.: And so Louis was enrolled in the National Institute for Blind Youth, in February of 1819 -- just a month after his tenth birthday. Before long, he made many new friends, and became a very happy boy indeed.

Unfortunately, however, his happiness did not last. In time, he discovered a serious difficulty in the way in which the school taught the basic skills of reading and writing. The difficulty lay with the huge books used to teach the alphabet, words, and sentences. These books were immense things, often measuring several feet in width -- almost the sort of volumes one might suspect only a giant would handle. Each thick, oversized page contained embossed, or raised, letters. These letters were often a full inch high. Because they were so large, only a few words could be put on a page. For this reason, a single story or textbook had to be divided into as many as three immense volumes, each one weighing close to 20 pounds apiece. The blind students "read" these outsized books by running their fingertips over the letters, and tried to understand their meaning by their sense of touch. Needless to say, Louis found the books extremely hard to handle and difficult to use. Finally, he decided one day to talk the matter over with the school's director.

LOUIS: M'sieu Director, these books are so BIG and CLUMSY! Cannot OTHER books be made for us -- books that are LIGHT, with small PAGES? Books we could read FAST and EASILY?

DIRECTOR: Ah, Louis, if only you knew how many MANY students ask the same question! But alas, the size is necessary! How else could the fingertips pick out the raised lettering? If the letters were smaller, how could you tell the difference between them? How could you tell a "C" from a "G", or a "U" from a "V", eh? Tell me that.

LOUIS: I suppose it would be impossible. But if only SOME WAY could be found to make the books SMALLER! If only SOME WAY could be found to make them easier to read!

DIRECTOR: I know, Louis . . . I know. I, too, would give ANYTHING if things could be made different. But alas, they cannot. We simply must do the best we can with what we have.

LOUIS: If only SOMEBODY could think of ANOTHER system, M'sieu Director. A BETTER system . . .

DIRECTOR: (A BIT JOCULAR) Eh, Bien! Maybe YOU'LL think of a better system some day, Louis . . . Maybe YOU will. . .

NARR.: Although the director's parting words may have been spoken half in fun, young Louis Braille very often found himself thinking seriously about the problem during the days that followed.

Then, one day toward the beginning of the year 1821, not long after Louis' 12th birthday, the director called all the students into the Institute's assembly hall to make a very special announcement.

SOUND: FADE IN MURMUR OF MALE VOICES OF VARYING AGES

DIRECTOR: (ECHO EFFECT) My young friends, I have called you together today to tell you about a man who not long ago invented a very interesting device. It is an invention I should like us to experiment with, here at the Institute.

The inventor's name is Captain Charles Barbier, an artillery officer with the French Army. He has invented a system of night writing, which he called "Sonography". This system is now in use with the army. It permits soldiers to read and write secret coded messages at night -- in total darkness -- without the aid of any light whatsoever!

Now--can you imagine how we might apply this military invention to our own purposes, here at the Institute?

SOUND: MURMUR OF VOICES

This clever invention consists of three things: a small metal plate measuring a little over an inch high and a half-inch wide...a special type of thick, heavy paper... and a special tool -- like a sharp nail -- to punch holes in this paper. This tool is called a "stylus."

Now, then -- let's talk first about the little metal plate. Upon this plate are a number of little dot-like dimples -- quite a bit like the face of a domino. Perhaps some of you have had an opportunity to hold a domino in your hand. If you have, you will find that Captain Barbier's metal plate FEELS like a domino in terms of its size and shape, as well.

Now, in order to write a message with this device, first place a piece of thick paper over the plate. Then, with the sharp, nail-like stylus, punch through the paper to the little dot-like dimples on the plate beneath. By punching these holes in different patterns, a secret coded message can be written. What happens is that when you have finished writing your message in this manner, the paper will have a whole series of these tiny pin-prick holes....You have a question, Louis?

LOUIS: M'sieu Director, perhaps I am stupid, but -- well, how can one POSSIBLY make sense out of a bunch of holes?

DIRECTOR: Ah! Holes indeed, Louis -- but HOLES IN REVERSE! Turn the paper over, and those holes now feel like raised dots-- EMBOSSED dots -- like little bumps! By passing your fingertips over them, your sense of touch will send the proper signals to your brain, your brain will decipher the raised dots in terms of letters and words -- eh viola! YOU ARE READING THE PAGE!

NARR.: And thus Louis Braille was introduced to Sonography, the military invention of a French artillery officer. It was an invention which was to one day change not only the course of Louis's own life, but the lives of millions of blind people the world over.

The Institute experimented with Captain Barbier's night writing system for several months. In time, however, the experiment proved a failure. As Louis and a close friend, Gauthier, talked about it later...

LOUIS: Gauthier, it is too bad the Captain's system did not work. I had held so much hope for it.

GAUTHIER: Actually, Louis, it was little more than a clever form of shorthand.

LOUIS: Shorthand! It was anything BUT short! Did you discover, as I did, how long it took to decode the messages?

GAUTHIER: Mais oui, Louis! THAT problem came about, I suppose, because one had to punch so many holes to form a single word. And that complicated dot code! It was SO hard to memorize!

LOUIS: What is more, Gauthier, the system did not spell out LETTERS and WORDS, but rather, the SOUNDS of the letters and words, instead. If only it had used the ALPHABET, instead of this -- this -- what do you call it? -- this -- this PHONETIC system!

GAUTHIER: Well -- it was a beautiful idea, this Sonography of Captain Barbier's. What a pity it had to die.

MUSIC: ATTACK INTO DOCUMENTARY UNDERSCORE

NARR.: But Captain Barbier's idea did NOT die. For Louis Braille that day determined to keep it alive. From the very start of the Institute's experiments with Sonography, he had realized the tremendous advantages it offered over the older, clumsier embossing system he had come so much to hate.

During the experiments, Louis had often given thought to correcting the faults in this system. Now, the 12-year-old set to the task with real enthusiasm. His first improvement was to reduce the number of dots on Barbier's metal slate from 12 to 6. This change made the system far more simple. It also brought all the dots within range of a single fingertip, and greatly improved the speed with which these dots could be read.

MUSIC: OUT

Yet, this improvement was only a humble start. Now, the actual CREATIVE work of Louis Braille was to begin. And the work promised to be mountainous indeed.

Louis' most important task was to develop an alphabet for the blind which could be felt with the fingertips alone. What's more, it had to be complete enough to contain all the letters of the regular alphabet, plus other information as well. This would have to include punctuation and accent marks, numbers, mathematical symbols and music notation. It also had to be simple -- simple enough to be understood by the average blind person.

Because Louis was kept so busy during the day with his studies, his only real chance to work on his alphabet came at night. Then, one could hear the soft clicking of his stylus against the metal plate as he toiled hour after hour over his invention.

SOUND: FADE IN SOFT CLICKING OF WRITING STYLUS

NARR.: He would work most often in the dormitory, long after his fellow students had fallen asleep. It was not at all unusual for Louis to work well into the early morning hours. Often he would suddenly be jolted into a realization of the time by the amazed voice of Gauthier. The lad would frequently awaken at the sound of the stylus and wonder aloud at Louis' odd working habits...

GAUTHIER: (WHISPERING -- SLEEPY-SOUNDING) Louis -- are you STILL UP?

LOUIS: (WHISPERING ALSO -- AND WEARY) Yes...I am working on my code. I am trying to make it easier to memorize and to use. As it is now, it is still too complicated. The code must be made much more simple before it can be read by all blind people, Gauthier.

GAUTHIER: Louis, do you realise what TIME it is?

LOUIS: A little after midnight, is it not?

GAUTHIER: MIDNIGHT? Louis, did you not hear the tower bell strike four o'clock, just a few moments ago?

LOUIS: Four o'clock in the morning?! No WONDER I have been growing so tired!

GAUTHIER: Louis, you simply must get more sleep at night!

LOUIS: I get enough, Gauthier.

GAUTHIER: Now you are REALLY joking! Have you forgotten the number of nights you fall asleep at your work table here, fully dressed? Or the times I must spend to wake you up mornings? Or the times you fall asleep in class?

LOUIS: No, Gauthier, I have not forgotten. But sleep or no sleep, the work has got to be done. There is simply no other time, Gauthier, no other time!

NARR.: Louis mercilessly pushed himself on in this manner for three long years. The cost to his health was tremendous. He grew more and more frail with the passing months. He eventually developed a constant cough which was to remain with him for the rest of his life. But great patience and hard work finally rewarded him with success.

MUSIC: ATTACK INTO DOCUMENTARY UNDERSCORE

In the fall of 1824, young Louis Braille completed his task -- the development of an alphabet for the blind. It was an alphabet complete enough to be used by almost any sightless individual. It contained 63 different symbols, including the entire alphabet, contractions, punctuation marks and codes standing for a number of commonly used words.

With this system, Braille swept away all the faults of the embossing method. His dotted symbols were simple and complete. They could be read rapidly and easily with a light touch of the finger. And they took up little more space than conventional letters.

All in all, his system was a genuine triumph. What's more, it was an achievement which even a fully grown man could be justly proud of. But for Louis Braille, the achievement was more remarkable still. For the thin, pale youth with the blond, curly hair was now just 15 years old.

MUSIC: OUT

When he told the Institute's director of what he had accomplished, the professor at once planned for a demonstration. It was held in a large classroom shortly after the supper hour. Louis sat alone at a desk in the center of the room. On the desk were his special writing plate, a sheet of his special writing paper, and his writing stylus. Ranged before him in a semi-circle were the entire staff of instructors, including the director himself.

SOUND: SLIP IN MURMUR OF MALE VOICES

NARR.: Suddenly, Louis spoke.

LOUIS: M'sieu Director, will you kindly read aloud something from one of your books, while I attempt to take down in my dot code the words you speak? Read it slowly and distinctly to me, please as though you were reading to a sighted friend who was going to copy down all your words. This will be a good test of how well I can take notes in class with my new system.

DIRECTOR: Very well, Louis. I believe a poem by the great blind poet, John Milton, would be most fitting for this demonstration. Let me see...Ah-Ha! Here is one titled "On His Blindness". This should do it very nicely. Ready, Louis?

LOUIS: Oui, M'sieu.

SOUND: SLIP IN CLICK OF STYLUS BENEATH FOLLOWING

NARR.: And the director began reading the poem in a slow, distinct voice, as the sightless youth took down in his dot code each and every word. When the professor had finished reading the poem, Louis read it back to him.

The director sat motionless for a moment, stunned by what he had just seen and heard. Then an expression of amazement mingled with joy spread swiftly over his face.

DIRECTOR: Congratulations, my young friend! Not a single mistake! Your system WORKS, Louis! It really WORKS!!

NARR.: Thus, after five long years of hard work, patience, trial and error, the brilliant 15-year-old blind boy succeeded completely where dozens of adults before him had failed. He had developed a totally workable alphabet for the blind. What's more, he had managed also to perfect a writing device to go along with it. And now, for the first time in the history of mankind, all the world's literature could be placed at the fingertips of the sightless!

Louis Braille's marvelous system was immediately put into use at the Institute, where it proved to be a great success. In the years that followed, he went on to improve and simplify his system. After graduation, he was made a full-time professor at the school, and for the next 22 years, he tried to persuade the French government to accept his alphabet and to have it taught to the blind students of France. But the acceptance of the system was slow in coming, as the publishers of the embossed books that he had battled for so long were very powerful, and fought bitterly to prevent its use.

At the age of 40, he was forced to give up his teaching career. The bad cough that had begun while he labored through those long, seemingly endless nights of experimentation, at last developed into a serious illness. He died three years later, on January the sixth, 1852, the victim of an incurable case of tuberculosis.

MUSIC: INSPIRATIONAL DOCUMENTARY UNDERSCORE

In his brief span of 43 years, Louis Braille did more for the sightless than all the pity, charity and misunderstanding heaped upon them since the beginning of time.

In 1878 -- 26 years after his death -- his remarkable invention was at last made the official, international system of writing for the blind. In 1952 -- just 100 years after his burial -- his body was removed from its simple grave near his birthplace at Coupvray, and placed in the famous Pantheon in Paris. And there it lies today, among the tombs of the greatest heroes of France.

MUSIC: UP TO END

RECORDED CODE LESSON TO FOLLOW THE DRAMA

Have you ever heard of the Morse Code? Maybe someone in your class can actually send and receive messages in Morse Code. And I'll bet there are several boys you know who can even send messages by semaphore. The system which Louis Braille perfected for helping blind people "see" through their fingertips is really a code -- like the Morse Code, or like semaphore.

Codes are PRIVATE languages -- only those people who know how to make sense out of them can understand the message that's being sent. When the United States government and the governments of other countries send messages to spies and secret agents and diplomats in other sections of the world, they use SPECIAL SECRET CODES.

If you've ever tried to decode messages in a newspaper or a magazine, you know how much fun it is to try to figure out the messages with the help of the clues which are given. Codes can be used in school, too. You can use them to hold secret elections, or to give directions for classroom activities.

Why don't you try to "crack" a code right now? First of all, I'll give you a clue about how to figure out the following message, which I'll give to you in just a moment. Now then -- here's the clue. Listen VERY closely:

A is 26 and Z is 1;
Break this code and have some fun!

Let's repeat that clue once more:

A is 26 and Z is 1;
Break this code and have some fun!

Now, get your paper and pencil ready, because we're all set to go! The following is a five-word message. As I read it to you, copy it down -- word for word and number for number. (PAUSE) All set? Here's the message, then in secret code:

First word: 14-26-16-22
Second word: 6-11
Third word: 2-12-6-9
Fourth word: 12-4-13
Fifth and last word: 24-12-23-22

Let me repeat that message once again, in case you might have missed a letter:

First word: 14-26-16-22
Second word: 6-11
Third word: 2-12-6-9
Fourth word: 12-4-13
Fifth and last word: 24-12-23-22

4

Once your teacher shuts off this recording, you can start decoding the secret message. If you have fun "cracking" the code, maybe you'll enjoy making up your own code. Later on, you might try it out on the other members of your class or on the members of your family to see what success they'll have in breaking it. See if THEY are as good as you are at breaking codes!

In fact, you might have a "code contest" in your room to see WHO can make up the BEST code. You'll probably find several good books in your school library which will help you to make up a code of your own. One of the best is CODES AND SECRET WRITING, by Herbert Zim.

Oh, by the way -- in case you're "stuck" in trying to figure out the secret message I gave you a moment ago, here's another clue for you. Listen very closely:

Y is 2 and W is 4;
Once you catch on, you're ready for more!

Well, you're all set now to "crack", or decode the secret message. After you've finished decoding it, check the answer you get with your teacher. In the meantime, have a "cracking good time!"

Supplementary Exercise for

"EYES AT THEIR FINGERTIPS"

Name: ______________________________ **Date:** ______________

One of the big reasons why Louis Braille thought of and worked out a way for blind people to read and write better was that the old way really bothered him. It really got under his skin that little blind children had to read out of books that were so big that they couldn't carry them around. And besides, reading raised or embossed writing wasn't very accurate. Try to think of as many things as you can that really bother you and get on your nerves -- things that bother you so much that you would like to change them or invent something new to make them less annoying. List as many of them as you can in the spaces below.

Of all of the things you listed on the first page, what bothers you most? What really gets you down? Is there any one of the things you listed on the first page that towers over all of the others and makes them seem small? Pick out one of the things you have just listed and write it in the blank below.

Now, think of all of the things you can about this annoyance or "thorn in your flesh" that make it annoying and list them below. What is there about it that bothers you?

In the spaces below list as many things as you can think of that would make it less annoying or remove the annoyance from your life. It doesn't have to be something that is now possible. Play being a magician and list all of the things that would make it ideal.

Now, think of something you could invent or some plan that would remove some of the things that bother you about this annoyance and would have as many as possible of the characteristics you listed at the bottom of the last page.

Louis Braille was helped in developing his kind of writing because he was familiar with sonography which had proved unsuccessful. Do you know of any unsuccessful attempts to solve the problem you selected? If you do, write them below. If you don't know of any, how could you find out if there have been any? Write your answer below.

If you thought of some unsuccessful attempt to solve your problem, what would have to be changed about it to make it successful?

Can you draw a picture or a diagram of the invention or plan which you have in mind? Sketch it below. If not, describe it as fully as possible.

If you were to succeed with your invention or plan, it would change many things. Think of as many things as you can that would probably be changed, if your invention or plan becomes successful. List them below.